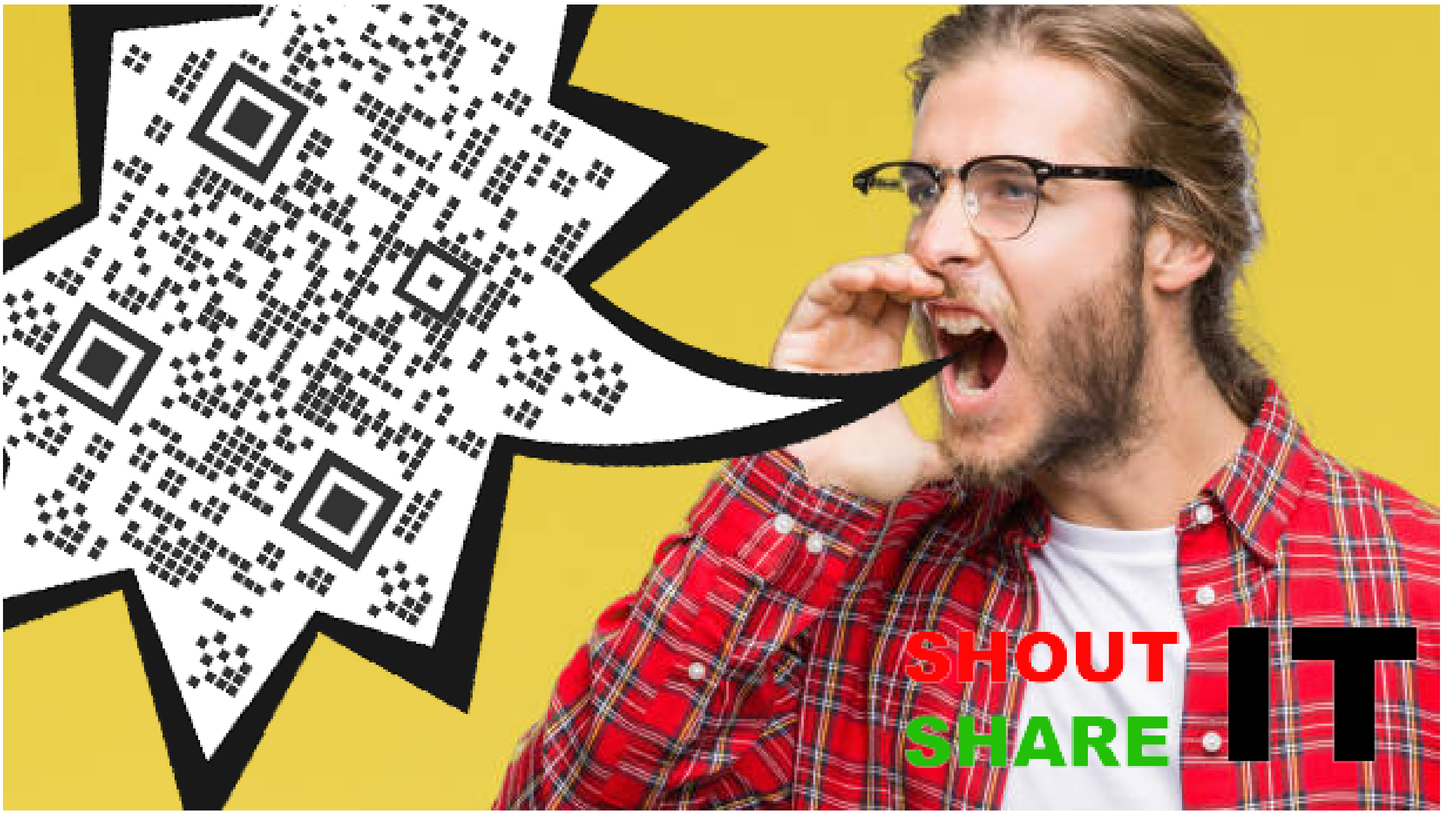
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BRITISH FISHES.

VOL. II.

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1989

A
HISTORY
OF
BRITISH FISHES.

BY

WILLIAM YARRELL, F.L.S. V.P.Z.S.

ABSQVE·DEO·NIHIL
CLEGHORN

ILLUSTRATED BY 500 WOOD-ENGRAVINGS.

IN TWO VOLUMES.—VOL. II.

SECOND EDITION.

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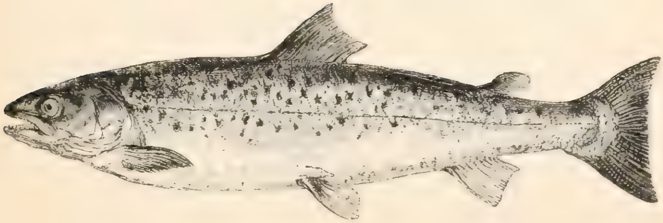
BRITISH FISHES.

ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.**



THE SALMON.

SMOLT, *young*. GRILSE, *first return from sea.*

Salmo salar, LINNÆUS.
,, ,, BLOCH, pt. i. pl. 20, female.
,, ,, ,, pt. iii. pl. 98, male in breeding season.
,, ,, *Salmon*, PENN. Brit. Zool. vol. iii. p. 382.
,, ,, ,, FLEM. Brit. An. p. 179, sp. 40.
,, ,, ,, JENYNS, Brit. Vert. p. 421.
,, ,, *Grilse*, JARDINE's Illust. Scot. Salm. pl. 8.
,, ,, ,, ,, ,, ,, ,, ,, 1 & 2.
,, ,, *Salmon*, ,, ,, ,, ,, ,, 7, old male, breeding state.

SALMO. *Generic Characters.*—Head smooth; body covered with scales; two dorsal fins, the first supported by rays, the second fleshy, without rays; teeth on the vomer, both palatine bones, and all the maxillary bones; branchiostegous rays varying in number, generally from ten to twelve, but sometimes unequal on the two sides of the head of the same fish.

THE SALMON is so well known for its quality as an article of food, as well as for the immense quantities in which it is taken, that it requires no other claims to recommend it strongly to our notice; and probably, in no country of the world, in proportion to its size, are the fisheries so extensive, or so valuable, as in the United Kingdom.

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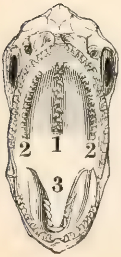
* The family of the Salmon and Trout.

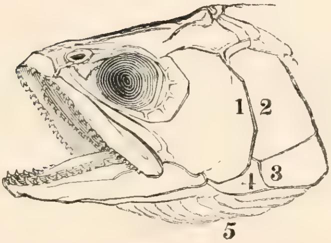
The history of the Salmon, and of the species of the genus *Salmo*, in this work, will extend to a considerable length; and some doubts existing as to the extent of their identity with the species of the *Salmonidæ* generally which are taken in the rivers or lakes of other countries of Europe, from the want of specimens with which to make actual comparative examination, the account of the species here inserted will be confined more particularly to a detail of what is known of them in this country only.

Of the species existing in this country, the characters and specific distinctions admit of considerable detail: too much reliance has been placed upon colour, without resorting sufficiently to those external indications, founded on organic structure, which may with greater certainty be depended upon.

In the scale of the relative value of parts affording characters for distinction, the organs of digestion, respiration, and motion are admitted by systematic authors to hold high rank; and in the hope to induce sportsmen to become zoologists — so far at least as to enable them to determine the various species they may meet with by a reference to those external characters which are the most important, — the specific distinctions in the genus *Salmo* will be illustrated by referring to the number and situation of the teeth, the form of the different parts of the gill-covers, and the size, form, and relative situation of the fins.

The outlines here introduced represent a front view of the mouth, and a side view of the head, of a common Trout. Of the first figure on the left hand, No. 1 marks



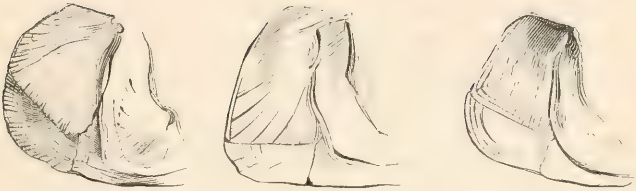


the situation of the row of teeth that are fixed on the central bone of the roof of the mouth, called the vomer: Nos. 2, 2, refer to the teeth on the right and left palatine bones; and the row of teeth outside each palatine bone on the upper jaw are those of the superior maxillary bones: No. 3, refers to the row of hooked teeth on each side of the tongue, outside of which are those of the lower jaw-bones. The Trout is chosen as showing the most complete series of teeth among the *Salmonidæ;* and the value of the arrangement, as instruments for seizure and prehension, arises from the interposition of the different rows, the four lines of teeth on the lower surface alternating when the mouth is closed with the five rows on the upper surface, those on the vomer shutting in between the two rows on the tongue, &c.

The second figure represents, in outline, a side view of the head, of which No. 1 is the preoperculum; No. 2, the operculum; No. 3, the suboperculum; No. 4, the interoperculum; No. 5, the branchiostegous rays: the four last parts together forming the moveable gill-cover. The different fins are sufficiently indicated by being coupled, when referred to, with the name of the part of the body of the fish to which they are attached.

The external appearance of the adult Salmon during the summer months, when it is caught in the estuaries of our large rivers, is too well known to require much description. The upper part of the head and back is dark bluish black; the sides lighter; the belly silvery white; the dorsal, pectoral, and caudal fins dusky black; the ventral fins white on the outer side, tinged more or less with dusky on the inner surface; the anal fin white; the small, soft, fleshy fin on the back, without rays, called the adipose, fat fin, or the second dorsal fin, is of the same colour nearly as the part of the back from which it emanates. There are mostly a few dark spots dispersed over that part of the body which is above the lateral line, and the females usually exhibit a greater number of these spots than the males.

These colours, differing but little, are, however, in a great degree common at the same period of the year to the three species that are the most numerous, as well as the most valuable; namely, the true Salmon, the Grey Trout, and the Salmon Trout; which are also further distinguished from the other species of the genus *Salmo* by their seasonal habit of moving from the pure fresh water to the brackish water, and thence to the sea, and back to the fresh water again, at particular periods of the year. Further specific distinctions are therefore necessary; and those that will be pointed out as existing constantly in these species will, it is hoped, enable observers to identify not only each of these, but also the other species of the genus, at any age or season.



The vignette above represents the form of the different parts of the gill-cover in the three species just named; of which the figure on the left hand is that of the Salmon, the middle one is the gill-cover of the Grey Trout, and that on the right hand is the gill-cover of the Salmon Trout: the differences are immediately apparent when thus brought into comparison.

In the Salmon, the posterior free edge of the gill-cover, as shown in the left-hand figure, forms part of a circle; the lower margin of the suboperculum is a line directed obliquely upwards and backwards: the line of the union of the suboperculum with the operculum is also oblique, and parallel with the lower margin of the suboperculum; the interoperculum is narrow vertically, and its union with the operculum is considerably above the line of the junction between the suboperculum and the operculum. The teeth of the Salmon are short, stout, pointed, and recurved: as stated in the generic characters, they occupy five situations at the top of the mouth; that is, a line of teeth on each side of the upper jaw, a line on each palatine bone, with one line on the vomer between the palatine bones when young, but the Salmon loses a portion of the vomerine teeth during the first visit to salt water. I have observed that some specimens of the migratory or Sea Trout carry their vomerine teeth longer than the Salmon; and those Trout which do not migrate appear to carry their vomerine teeth longer than those Trout which do migrate. The teeth on the vomer of the Salmon, when the fish is old, seldom exceed two or three in number, sometimes only one, and that placed on the most anterior part. The Salmon has besides these, two rows of teeth upon the tongue, and one row along the outer upper edge of each lower jaw-bone.

The inner surface of the pectoral fin is in part dusky: the tail very much forked when young; the central caudal rays growing up, the tail is much less forked the third year, and by the fifth year it is become nearly or quite square at the end.

The descriptions of the gill-covers of the other species will be given in the account of the fish to which they belong; but it may be remarked here, that looking at the form of the three gill-covers, it will be obvious that a line drawn from the front teeth of the upper jaw to the longest backward projecting portion of the gill-cover, in either species, will occupy a different situation in respect to the eye; that the line will fall nearest the centre of the eye in the first, that of the Salmon, and farthest below it in the second, that of the Grey Trout.

As further specific distinctions in the Salmon, I may add that, according to Dr. Richardson, the cæcal appendages are in number from sixty-three to sixty-eight; and several observers have stated the number of vertebræ to be sixty, which I have repeatedly found to be correct.

Commencing, then, with the true Salmon, which ascend the rivers, in the state as to colour before mentioned, sooner or later in the spring or summer months, it is observed that some rivers are much earlier than others, the fish in them coming into breeding condition and beginning to spawn at an earlier period.

Rivers issuing from large lakes afford early Salmon, the waters having been purified by deposition in the lakes: on the other hand, rivers swollen by melting snows in the spring months are later in their season of producing fish, and yield their supply when the lake rivers are beginning to fail. "The causes influencing this," says Sir William Jardine, to whom I am indebted for much valuable information on the *Salmonidæ*, as well as many specimens, "seem yet undecided; and where the time varies much in the neighbouring rivers of the same district, they are of less easy solution. The Northern rivers, with little exception, are, however, the earliest,—a fact well known in the London markets; and going still farther north, the range of the season and of spawning may be influenced by the latitude." Artedi says, "in Sweden the Salmon spawn in the middle of summer."

"It has been suggested that this variation in the season depended on the warmth of the waters; and that those Highland rivers which arose from large lochs were all early, owing to the great mass and warmer temperature of their sources, — that the spawn there was sooner hatched. There are two rivers in Sutherlandshire which show this late and early running under peculiar circumstances. One, the Oikel, borders the county, and springs from a small alpine lake, perhaps about half a mile in breadth; the other, the Shin, is a tributary to the Oikel, joins it about five miles from the mouth, but takes its rise from Loch Shin, a large and deep extent of water, and connected to a chain of other deep lochs. Early in the spring, all the Salmon entering the common mouth diverge at the junction, turn up the Shin, and return as it were to their own and warmer stream, while very few keep the main course of the Oikel until a much later period."

Dr. Heysham, in his Catalogue of Cumberland Animals, has supplied similar evidence. "The Salmon," it is there observed, "is plentiful in most of our rivers, in all of which they spawn; but they evidently prefer, during the winter and spring, the Eden to the Esk, the Caldew, or the Peteril. Although the Esk and the Eden pour out their waters into the same estuary, and are only separated at the mouths by a sharp point of land, yet there is scarcely an instance of a new Salmon ever entering the former until the middle of April or beginning of May. The fishermen account for this curious fact from the different temperature of these two rivers; the waters of the Eden, they allege, being considerably warmer than the water of the Esk; which is not altogether improbable, for the bed of the Esk is not only more stony and rocky than the Eden, but is likewise broader, and the stream more shallow; consequently its waters must be somewhat colder in the winter season. It is an undoubted fact, that snow water prevents the Salmon from running up even the Eden: it is probable this circumstance may have considerable effect in preventing them from entering the Esk till the beginning of summer, when the temperature of the two rivers will be nearly the same. The Peteril joins the Eden a little above, and the Caldew at Carlisle; yet up these rivers the Salmon never run unless in the spawning season, and even then in no great numbers."

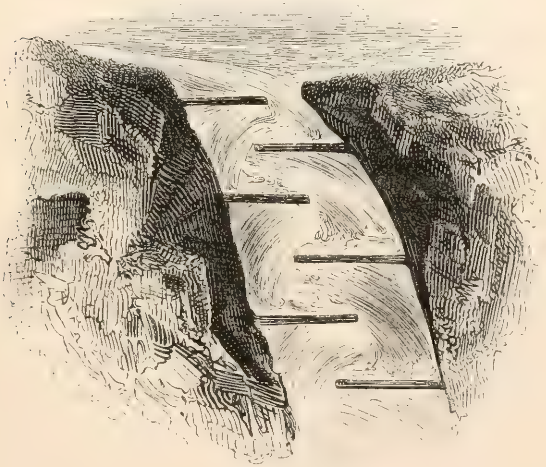
The number of fish obtained in the spring in a proper state for food is small compared with the quantity procured as the summer advances. During the early part of the season, the Salmon ascend the river, advancing with the flood, and generally retiring with the ebb, if their progress be not stopped by any of the various means employed to catch them, which will be explained hereafter. It is observed that the female fish appear before the males; and the young fish on their first return from the sea, called Grilse till they have spawned once, ascend earlier than those of more adult age. As the season advances, the Salmon ascend higher up the river beyond the influence of the tide: they are observed to be getting full of roe, and are more or less out of condition according to their forward state as breeding fish. Their progress forwards is not easily stopped; they shoot up rapids with the velocity of arrows, and make wonderful efforts to surmount cascades and other impediments by leaping, frequently clearing an elevation of eight or ten feet, and gaining the water above, pursue their course. If they fail in their attempt and fall back into the stream, it is only to remain a short time quiescent, and thus recruit their strength to enable them to make new efforts.

These feats of the Salmon are frequently watched with all the curiosity such proceedings are likely to excite. Mr. Mudie, in the British Naturalist, describes from personal observation some of the situations from which these extraordinary efforts can be witnessed. Of the fall of Kilmorac, on the Beauly, in Invernesshire, it is said, " The pool below that fall is very large; and as it is the head of the run in one of the finest Salmon rivers in the North, and only a few miles distant from the sea, it is literally thronged with Salmon, which are continually attempting to pass the fall, but without success, as the limit of their perpendicular spring does not appear to exceed twelve or fourteen feet: at least, if they leap higher than that they are aimless and exhausted, and the force of the current dashes them down again before they have recovered their energy. They often kill themselves by the violence of their exertions to ascend; and sometimes they fall upon the rocks and are captured. It is indeed said that one of the wonders which the Frasers of

Lovat, who are lords of the manor, used to show their guests, was a voluntarily cooked Salmon at the falls of Kilmorac. For this purpose a kettle was placed upon the flat rock on the south side of the fall, close by the edge of the water, and kept full and boiling. There is a considerable extent of the rock where tents were erected, and the whole was under a canopy of overshadowing trees. There the company are said to have waited until a Salmon fell into the kettle and was boiled in their presence. We have seen as many as eighty taken in a pool lower down the river at one haul of the seine, and one of the number weighed more than sixty pounds."

At the meeting of the British Association, held at Glasgow in September 1840, Mr. Smith, of Deanston in the Carse of Stirling, exhibited a model, which is thus noticed in the Report of the Proceedings of the Natural History Section in the Literary Gazette. " Mr. Smith gave an interesting account of a stair which he had invented, whereby Salmon might be enabled to ascend streams, notwithstanding the existence of natural or artificial obstructions, and so constructed as not to diminish the power of the water, or lessen the supply to mills ; it being understood that the disputes between the owners of mills and of salmon-fisheries had hitherto led to much disagreement and inconveniency. He illustrated his observations by the model of an experimental erection which he had constructed on the Teith, near Doune, the result of which had been so successful, that numerous applications had been made from various quarters for erections of the same kind. Mr. Smith mentioned that, in connexion with this invention, he had in contemplation the construction of an apparatus, or index, whereby the exact number of fish that passed up the stream by the stair might be accurately ascertained, together with the time of their so passing up, and the size and thickness of the fish. It is difficult to give a perfect idea of this ingenious contrivance without a model. It consists of one side of the river, under a weir or 'cauld,' being separated from the main stream, and intersected by transverse pieces of wood, or stone, from each side, crossing, perhaps, two-thirds of the width, and with considerable intervals between the opposite intersections. The fish, it seems, both from the experience on the Teith, and at another dam at Blantyre, on the Clyde, immediately adopt this staircase in ascending the rivers, and, finding resting-places between the intersecting materials, abandon the other parts of the stream for this contingency. Some amusing remarks were made on this communication, which is one of infinite value to local mill and fishing interests."

The fish having at length gained the upper and shallow pools of the river, preparatory to the important operation of depositing the spawn in the gravelly beds, its colour will be found to have undergone considerable alteration during the residence in fresh water. The male becomes marked on the cheeks with orange-coloured stripes, which give it the



appearance of the cheek of a *Labrus ;* the lower jaw elongates, and a cartilaginous projection turns upwards from the point, which, when the jaws are closed, occupies a deep cavity between the intermaxillary bones of the upper jaw; the body partakes of the golden orange tinge, and the Salmon in this state is called a red-fish. The females are dark in colour, and are as commonly called black-fish; and by these terms both are designated in those local and precautionary regulations intended for the protection and preservation of the breeding fish.

The process of spawning has been described by various observers. "A pair of fish are seen to make a furrow, by working up the gravel with their noses, rather against the stream, as a Salmon cannot work with his head down stream, for the water then going into his gills the wrong way, drowns him. When the furrow is made, the male and female retire to a little distance, one to the one side and the other to the other side of the furrow: they then throw themselves on their sides, again come together, and rubbing against each other, both shed their spawn into the furrow at the same time. This process is not completed at once; it requires from eight to twelve days for them to lay all their spawn, and when they have done they betake themselves to the pools to recruit themselves. Three pairs have been seen on the spawning-bed at one time, and were closely watched while making the furrow and laying the spawn."*

The following extracts are made from a paper by Dr. Knox, published in the Transactions of the Royal Society of Edinburgh.

"November 2.—Salmon are observed to be spawning in the various tributary streams of the Tweed which join that river from the north, and a pair are watched. The ova observed to be deposited near the sources of the stream on the 2nd of November, and covered up with gravel in the usual way."

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* Ellis on the Natural History of the Salmon.

"February 25, or a hundred and sixteen days after being deposited, the ova, on being dug up, are found to be unchanged. If removed at this time, and preserved in bottles filled with water, the developement of the egg may be hastened almost immediately by being put into warm rooms: it is not necessary to change the water. The fry so hatched, *i. e.* artificially, cannot be preserved alive in bottles longer than ten days; they eat nothing during their confinement."

"March 23.—The ova now changing; the outer shell cast; the fry are lying imbedded in the gravel, as fishes somewhat less than an inch in length, being now twenty weeks from the period of their deposition."

"April 1. — On reopening the spawning-bed, most of the fry had quitted it by ascending through the gravel. During a former series of observations I have found the ova imbedded in the gravel unchanged on the 10th of April, and as fry or fishes, but still imbedded in the gravel, on the 17th: they were taken that year, with fly, as Smolts, on the 22nd of April, about the size of the little finger."

Some specimens of Salmon fry now before me, with a portion of the ovum still attached to the abdomen of each fish, measure one inch in length: the head and eyes are large; the colour of the body pale brown, with nine or ten dusky grey marks across the sides. These dusky patches, longer vertically than wide, are common, I have reason to believe, to the young of all the species of the genus *Salmo*. I have seen them in the young of the Salmon, Grey Trout, Sea Trout, Common Trout, and Charr. In a specimen of the young of the Salmon six inches long, these transverse marks are still observable when the fish is viewed in a particular position in reference to the light: and if the scales are removed, the marks are much more obvious. They are also very distinct in the Common Trout and in the Charr for a considerable time.

There are striking examples in other animals of this similarity in the markings, or family likeness, in the young of the various species of the same genus, however different may be the colours of the parent animals. The young of the lion and the puma are as much marked for a time as the young of the tiger and leopard, or, indeed, of any of the other cats, whether striped or spotted; and the young of all deer are said, and many are known, to be spotted, though it is also known that the greater number of the adult animals are perfectly plain.

I am now enabled, through the kindness of Thomas Lister Parker, Esq., to offer some remarks on the growth of the young Salmon in fresh water, and in order to prevent any misconception of the terms employed, I shall speak of the young Salmon of the first year as a Pink; in its second year, till it goes to sea, as a Smolt; in the autumn of the second year as Salmon Peal, or Grilse, and afterwards as adult Salmon.

In the autumn of the year 1835, Thomas Upton, Esq. of Ingmire Hall, situated between Sedbergh and Kendal, began to enlarge a lake on his property, and in the spring of 1836, some Pinks from the Lune, a Salmon river which runs through a valley not far from the lake, were put into it. This lake, called Lillymere, has no communication with the sea, nor any outlet by which fish from other waters can get in, or by which those put in can get out. The Pinks when put into Lillymere did not certainly exceed three inches and a half in length. Sixteen months afterwards, — that is, in the month of August 1837, Thomas L. Parker, Esq. then visiting his friend, fished Lillymere, desirous of ascertaining the growth of the Pinks, and with a red palmer fly caught two Salmon Peal in excellent condition, silvery bright in colour, measuring fourteen inches in length, and weighing fourteen ounces. One was cooked and eaten, the flesh pink in colour, but not so red as those of the river; well flavoured and like that of a Peal. The other was sent to me in spirit of wine, and a drawing of it immediately taken. In the month of July 1838, eleven months after, another small Salmon was caught, equal to the first in condition and colour, about two inches longer and three ounces heavier. No doubt was entertained that these were two of the Pinks transferred to the lake in the spring of 1836, the first of which had been retained sixteen months, and the other twenty-seven months, in this fresh-water lake.

Desirous of ascertaining the appearance of the young Salmon at periods intermediate between the states as Pinks and Salmon Peal, other experiments were tried. Pinks in the river Hodder in the month of April are rather more than three inches long, and are considered to be the fry of that year: at this time, Smolts of six inches and a half are also taken. The Smolts are considered as the fry of the previous year, and are distinguished by the blue colour on the upper half of their body, the silvery tint of the lower half, and the darker hue of the fins generally as compared with those of the Pink. In this state as to colour, the Smolts are said to have assumed their migratory dress and go down to the sea in May. In June the young Pink in the Hodder measures about four inches; in July it measures five inches, and no Smolts are then found in the river. To be further convinced of this change, and the length of time required to produce it, a Pink put into a well at Whitewell in the forest of Bowland in November 1837, was taken out in the state of a Smolt of six inches and a quarter in July 1838. In another instance more Pinks by Mr. Upton's directions were put into Lillymere in September 1837, and Mr. Parker caught five or six in the state of Smolts of seven and a half inches in August 1838. In referring to the particular size of the Pinks in the river Hodder at stated periods, it may be necessary to remark that the Pinks of different rivers, and even in the same river, will be found to vary in size, depending on the time at which the spawn was deposited, the temperature of the season, and other causes.

I may here observe that I am indebted to the kindness and liberality of Thomas Lister Parker, Esq. for a variety of specimens, as well as for the requisite information concerning them. Of the various fishes, when received, accurate drawings were immediately made, and coloured representations of the natural size of six examples at different ages, in illustration of this subject, were published.*

A knowledge of the growth of young Salmon in a fresh-water lake, as here described, and the experiment has succeeded elsewhere, may be useful to those gentlemen who possess lakes near Salmon rivers from which they can supply them with Pinks: whether the Salmon thus prevented going to salt water will still retain sufficient constitutional power to mature their roe, and by depositing it in the usual manner, as far as circumstances permit, produce their species, would be a subject worthy of further investigation. That the rate of growth in young Salmon has some reference to the size of the place to which they are restricted, receives further confirmation in these river, lake, and well specimens. The Smolt taken from the well in July 1838, where it had been confined for eight months, was rather smaller in size at that time than the Smolts in the Hodder in the preceding April, though both were Pinks of the same year, namely 1837. The Smolt taken from the lake in August 1838, which then measured seven inches and a half, had also grown more rapidly than that in the well, but had not acquired the size it would have gained had it been allowed to go to sea. Further, it may be observed, that the Salmon Peal from the lake in August 1837, then eighteen months old, though perfect in colour, is small for its age; while that of July 1838, or twenty-nine months old, is comparatively still more deficient in growth, supposing both fish to have resulted from Pinks of the year 1836, and been put into the lake at the same time; of which there was no doubt, since the lake, the formation of which, though commenced in the autumn of 1835, was not finished till February 1836, soon after which the first Pinks were put in.

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* On the growth of the Salmon in Fresh-water.—John Van Voorst: London, 1839.

In another experiment, a large landed proprietor in Scotland, whose name I do not know that I am at liberty to mention, wrote as follows :—"In answer to your inquiry about the Salmon fry I have put into my newly-formed pond, I must tell you, the water was first let in about the latter end of 1830, and some months afterwards, in April 1831, I put in a dozen or two of small Salmon fry, three or four inches long, taken out of a river here, thinking it would be curious to see whether they would grow without the possibility of their getting to the sea or salt water. As the pond, between three and four acres in extent, had been newly stocked with Trout, I did not allow any fishing till the summer of 1833, when we caught with the fly several of these Salmon, from two to three pounds' weight, perfectly well shaped, and filled up, of the best Salmon colour outside, the flesh well-flavoured and well-coloured, though a little paler than that of new-run fish."

I have purposely adverted to the growth of the fry of the Salmon in fresh water, as stated by Dr. Knox, Mr. Parker, and others, in order to introduce the important experimental observations of Mr. John Shaw on the development and growth of Salmon fry, from the exclusion of the ova to the age of two years; and that I may do justice to so interesting a subject, I include a large portion of Mr. Shaw's paper as it appeared in the Transactions of the Royal Society of Edinburgh.

" That the facts which I communicate regarding the natural history of the Salmon in its earlier stages, may not appear altogether undeserving of consideration, I may premise that my remarks have not proceeded from hasty or imperfect observation, but from the experience of many years sedulously devoted to the subject, the whole of my life, with the exception of a few seasons, having been spent on the banks of streams where Salmon are in the habit of depositing their spawn, and where of course the Parr is likewise abundant. My opportunities of observation have thus been as ample, as my efforts have been unremitting and laborious, to discover the true history of this invaluable species. I shall here present a brief abstract of my earlier proceedings in relation to the subject.

" I had long been of opinion, in opposition to the sentiments entertained by the majority of authors, that the fish commonly called *Parr*, was the natural produce of the Salmon, and that all recorded attempts to trace the history of the latter fish were fanciful in their nature, and delusive in their results. To enable me to watch the progressive growth of Parr, I caught seven of these small fishes on the 11th of July 1833, and placed them in a pond supplied by a stream of wholesome water. There they continued to thrive remarkably well, and were seen catching flies and other insects, and sporting on the surface in perfect health. In the month of April following (1834), they began to assume a different aspect from that which they exhibited when first put into the pond, and this change was evident enough even while they continued swimming at large in the water; but wishing to examine them more particularly, and at the same time to convince others of the fact of their having changed their external character, I caught them with a casting-net on the 17th May, 1834, and satisfied every individual present that they had assumed the usual appearance of what are called *Salmon smolts* or *fry*. They were now of a fine deep blue upon the back, with a delicate silvery appearance on the sides, and the abdomen white; these silvery scales came easily off upon the hand. A circumstance occurred about the first week of May, which it may be proper to mention, as illustrating in some manner what may be deemed the migratory instinct of these fishes. They seemed to me at this time to be decreasing in numbers, and I found, on examination, that some had leapt altogether out of the pond, and were lying dead at a short distance from its edge.

"In March 1835, I again took twelve Parrs from the river of a larger size, that is, about six inches long; they then bore the perpendicular bars, and other usual characters of that fish. These I also transferred to a pond prepared for the purpose, and, by the end of April, they too assumed the characters of the Salmon-fry,—the bars becoming overlayed by the new silvery scales, which Parrs of two years old invariably assume before departing towards the sea. From these experiments I had no doubt that the larger Parrs observable in rivers in autumn, winter, and early spring, were in reality the actual Salmon-fry advancing to *the conclusion of their second year*, and that the smaller summer Parrs (called in Dumfriesshire May Parrs), were the same species, but younger as individuals, and *only entering upon* their second year. This, then, I conceived to be the detection of the main error of preceding observers, who had uniformly alleged that salmon-fry attain a size of six or eight inches in as many weeks, and after the lapse of this brief period take their departure to the sea. It is the rapidity with which the two year old Parr assumes the aspect of the salmon-fry that has led to this false conclusion, and superficial or hasty observers, taking cognizance, 1st, of the hatching of the ova in early spring, and, 2dly, of the sea-ward migration of Smolts soon afterwards, have imagined these two facts to take place in immediate or speedy succession. I may now mention what actually becomes of these young fishes for some weeks after they are hatched.

"That the fish in question should not be found in the river in an earlier state than that in which it is named the May or summer Parr, had long appeared to me to be an extraordinary and perplexing circumstance. I therefore made a minute examination of the streams where the old Salmon had spawned the preceding winter, and I there found in vast numbers a very small but active fish, which I concluded to be the young Parr or Samlet of the season. To prove the fact, I scooped up with a gauze-net two or three dozen of them, on the 15th of May, 1834. They measured about an inch in length; their heads were large in proportion to their bodies, and the latter tapered off towards the tail, in the form of a wedge. The small transverse bars, characteristic of the Parr, were already distinctly marked. I placed them in two ponds, each provided with a run of water, where they throve well. In the course of the succeeding May (1835), that is, when they were more than a year old, and had been twelve months in my possession, I took a few of them from the pond for the purpose of examination. They had increased to the length of three and a half inches, on an average, and it is important to remark, that they correspond in every respect with the Parr of the same age which occurred in the river; but neither as yet indicated any approach to the silvery aspect of the Smolt. Being satisfied, however, from the result of my former experiments on the Parr, that they would ultimately assume that silvery aspect, I continued to detain them in the pond, and, accordingly, in May 1836, they were transmuted into Smolts or Salmon-fry, commonly so called. At this time they measured six and a half inches in length, their colour on the back a beautiful deep blue, the sides bright and silvery, the dorsal, caudal, and especially the pectoral fins, tipped with black, the abdomen, ventral, and anal fins white. The undoubted Smolts of *the river* were at this time descending sea-wards, and the most careful comparison of these with those in my possession did not elicit the slightest difference between the two. Mine had completed their second year, and is it likely that those in the river which so identically resembled them, were only a few weeks old ?

" The minute but active fish above alluded to, is at that early period to be no where found except in those streams (or their immediate vicinity) in which the old Salmon had deposited their spawn during the preceding winter. Early in April 1835, I discovered them in one of these streams, but so young and weak, owing to their very recent emergence from the spawning-bed, as to be unable to struggle with the current where it flowed with any strength or rapidity. They therefore betook themselves to the gentler eddies, and frequently into the small hollows produced in the shingle by the hoofs of horses which had passed the ford. In these comparatively quiet places, and covered by a slight current of a few inches in depth, they continued with their little tails in constant motion, till such time as my near approach was perceived, when they immediately darted beneath the stones. They remain with these habits, and in the situations just mentioned, during the months of April, May, and even June ; but as they increase in size and strength, they scatter themselves all over the shallower parts of the river, especially wherever the bottom is composed of fine gravel. They continue, in truth, comparatively unobserved throughout the whole of the first summer, being seldom taken by the angler during that season. But when the two-year-olds have disappeared (as Smolts) in spring, these smaller fishes, now entering their second year, become bolder and more apparent, and now constitute the May and summer Parr of anglers. But their timid habits during the first few months of their existence, and their consequent concealment in the shingle, greatly screen them from observation during that period, and have led to the erroneous belief, that the silvery Smolts were the actual produce of the season, and were only a few weeks old. It certainly seems singular that it should never have occurred to any intelligent angler to inquire what had become of the older generation of Parr, that is of the comparatively large individuals which he might have captured late in autumn and in earliest spring, but none of which he can detect after the departure of the so-called Smolts. If the two are not identical, how does it happen that the one so constantly disappears simultaneously with the other? Yet no one alleges that he has ever seen Parr, *as such*, performing their migration towards the sea. They cannot do so, because they have been previously converted into Smolts.

"I shall here allude briefly to three different occasions on which I have had an opportunity of witnessing the first migration of Smolts or converted Parr, that is, their descent in small shoals towards the sea. The first of these was in the first week of May, 1831. I was able deliberately to inspect them as the several shoals arrived behind the sluices of a salmon-cruive, and while they yet remained in the water, and were swimming in a particular direction, indistinct transverse lateral bars might still be seen, but as they changed their position, these became as it were lost in the silvery lustre. I also examined many of them in the hand, and could there also, by holding them at a certain angle in relation to the eye, produce the barred appearance, but when the fish were held with their broad side directly opposed to view, the character alluded to could not be seen. Its actual existence, however, could be easily proved by removing the deciduous silvery scales, when the barred markings became apparent, and, of course, continued so to whatever light exposed. My next opportunity occurred on the 3rd of May, 1833. The appearance was exactly the same as that which I have just described. They passed down the river in small family groups or shoals of from forty to sixty and upwards, their rate of progression being about two miles an hour. The caution which they exercised in descending the several rapids they met with in the course of their journey was very amusing. They no sooner came within the influence of any rapid current than they in an instant turned their heads up the stream, and would again and again permit themselves to be carried to the very brink, and as often retreat upwards, till at length one or two, bolder than the others, permitted themselves to be carried over the current, when the entire flock, one by one, disappeared, and then, so soon as they had reached comparatively still water, they again turned their heads towards the sea, and resumed their journey. The third opportunity to which I shall here refer occurred in May 1836, at which time, as I have stated, I compared a few of the descending Smolts with those which (having been two years in my possession as Parr) had, in the confinement of the Pond, assumed the corresponding silvery aspect of the Salmon-fry. The river during this month being remarkably low, I was thus enabled to ascertain more accurately the time during which they continued to migrate, which I found to be nearly throughout the whole of the month, but more especially in the course of the second week, in which the shoals were both larger, and more frequent in their successive arrivals. Their external aspect was the same as that of the former shoals, and the average length, as usual, from six to seven inches.

" Having thus traced the progress of the Parr from an inch in length, through its several stages up to the period of migration, I shall now detail my various experiments on the ova of the Salmon, undertaken with a view to prove the identity of these two fish. On the 10th of January, 1836, I observed a female Salmon of considerable size (about sixteen pounds), and two males, of at least twenty-five pounds, engaged in depositing their spawn. The spot which they had selected for that purpose was a little apart from some other Salmon which were engaged in the same process, and rather nearer the side, although still in pretty deep water. The two males kept up an incessant conflict during the whole of the day, for possession of the female, and, in the course of their struggles, frequently drove each other almost ashore, and were repeatedly on the surface displaying their dorsal fins, and lashing the water with their tails. Being satisfied that these were real Salmon, there being at least ten brace of that fish engaged in the same process on the stream at the time, I took the opportunity of securing as much of the ova as I could possibly obtain. This I did three days after it was deposited, the males and female still occasionally frequenting the bed. The method by which I obtained the eggs was by using a thin canvass bag, stitched on a slight frame formed of small rod iron, in fashion of a large square landing-net, one person holding this bag a few inches farther down the stream than where the ova were deposited, and another with a spade digging up the gravel, the current carrying the eggs into the bag, while the greater portion of the gravel was left behind. Having thus obtained a sufficient quantity of the ova for my purpose, I placed them in gravel under a stream of water where I could have a convenient opportunity of watching their progress. The stream was pure spring water. On the 26th of February,—that is, forty-eight days after being deposited, I found on close inspection that they had some appearance of animation, from a very minute streak of blood which appeared to traverse for a short distance the interior of the egg, originating near two small dark spots, not larger at that time than the point of a pin. These two dark spots, however, ultimately turned out to be the eyes of the embryo fish, which was distinctly seen resting against the interior surface of the egg a few days previous to its exclusion. On the 8th of April, which makes ninety days imbedded in the gravel, I found on examination that they were excluded from the egg, which was not the case a day or two previous. The temperature of the water at the time was 43°, the temperature of the water in the river 45°, and the temperature of the atmosphere 39°. On its first exclusion, the little fish has a very singular appearance. The head is large in proportion to the body, which is exceedingly small, and measures about *five-eighths of an inch* in length, of a pale blue or peach-blossom colour. But the most singular part of the fish is the conical bag-like appendage which adheres by its base to the abdomen. This bag is about two-eighths of an inch in length, of a beautiful transparent red, very much resembling a light red currant, and in consequence of its colour, may be seen at the bottom of the water when the fish itself can with difficulty be perceived. The body also presents another singular appearance, namely,

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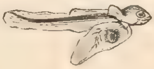

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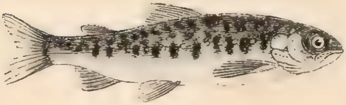


a fin or fringe, resembling that of the tail of the tadpole, which runs from the dorsal and anal fins to the termination of the tail, and is slightly indented. This little fish does not leave the gravel immediately after its exclusion from the egg, but remains for several weeks beneath it with the bag attached, and containing a supply of nourishment, on the same principle, no doubt, as the umbilical vessel is known to nourish other embryo animals. By the end of fifty days, or the 30th of May, the bag contracted and disappeared. The fin or tadpole-like fringe also disappeared by dividing itself into the dorsal, adipose, and anal fins, all of which then became perfectly developed. The little transverse bars, which for a period of two years (as I have already shown) characterize it as the Parr, also made their appearance. Thus, from the 10th of January till the end of May, a period of upwards of one hundred and forty days was required to perfect this little fish, which even then measured little more than one inch in length, and corresponded in all respects with those on which I had formerly experimented, as well as with such as existed at that same time in great numbers in the natural streams.

" Although I was myself satisfied by the preceding facts that Parr and Salmon fry were thus identical in kind, and differed only in respect to age, I was informed that my inferences were objected to, in as far as there was not sufficient evidence that the spawn experimented on was actually that of Salmon, seeing that the same streams were accessible to other species of the genus. I therefore felt it incumbent on me to supply this desired link in the chain of evidence, and I accordingly repeated my experiments on ova which I *saw excluded*, which, in fact, I forced the Salmon to exclude, in the manner after mentioned, preserving at the same time the skins of the parent fish, for the satisfaction of the curious or sceptical.

“ Before proceeding to make additional experiments, it was necessary to lay my experimental basins dry, not only for the purpose of removing the young Salmon of the preceding season’s produce, but also to enable me to fit them up on such a principle as would exclude any possibility of confusion either from the overflowing of the ponds themselves, or from the flooding of the river Nith, on the banks of which they are situate. Every precaution was used not only to exclude error, but to place the young fry in circumstances as nearly resembling the state of nature as was consistent with their preservation.

“ The ponds, which are three in number, are two feet deep, and thickly embedded with gravel, while they are at the same time supplied with a small stream of spring water in which the larvæ of insects abound. Pond No. 1 is twenty-five feet in length by eighteen in breadth, and is fed by the stream, which debouches into it at the fall. Pond No. 2 is twenty-two feet in length by eighteen in breadth, and is fed from pond No. 1, where the communication is carefully grated with wire. Pond No. 3 is fifty feet in length by thirty in breadth, and is fed by the stream, having no communication with either of the other ponds. The waste water from pond No. 1 is conducted into pond No. 2, through a square wooden pipe covered at the mouth with a wire grating, the bars of which are about one-eighth of an inch apart. The waste water from pond No. 2 is conveyed under ground to the distance of twenty feet in a square wooden pipe, grated in the same manner as the former. The waste water from pond No. 3 passes down a square wooden pipe two feet deep, covered at the top with wire-gauze, and is conveyed under ground in a small covered drain to the distance of twenty feet from the pond. The water of the whole is then left to find its way to the river.

" To prevent any communication arising from an accidental overflow of the ponds themselves, I raised embankments upon the intersecting walks of two feet in height, so that the several families of fish which the ponds contain can have no access, direct or indirect, to each other. Where the rivulet is divided for the purpose of supplying the several ponds, I have formed an artificial fall in each stream, of a construction to prevent the fish from ascending one stream and descending another. Finally, where the water discharges itself from the ponds, the channels are so secured by wire-grating that it is as impossible for the young fish to escape as for any other fish to have access to them. The whole occupies an area of nearly eighty feet square.

" My experimental basins being thus prepared, my next object was to secure the fish, the progeny of which were to form the subject of experiment. With the view, therefore, of securing two Salmon, male and female, while in the very act of continuing their kind, I provided myself with an iron hoop five feet in diameter, on which I fixed a net of a pretty large mesh, so constructed as to form a bag nine feet in length by five feet in width. I then attached the hoop and net to the end of a pole nine feet long, thus forming a landing net on a large scale. The weight of the net with its iron hoop being upwards of seven pounds, it instantly sank to the bottom on being thrown into the water.

" Being thus prepared with all the means of carrying my experiment into practice, I proceeded to the river Nith on the 4th January 1837, and readily discovered a pair of adult Salmon engaged in depositing their spawn. They were in a situation easily accessible, the water being of such a depth as to admit of my net being employed with certain success. Before proceeding to take the fish, I formed a small trench in the shingle by the edge of the stream, through which I directed a small stream of water from the river two inches deep. At the end of this trench, I placed an earthenware basin of considerable size, for the purpose of ultimately receiving the ova. I then, at one and the same instant, enclosed both the fish in the hoop, allowing them to find their way into the bag of the net by the aid of the stream. In capturing these fish, I considered myself fortunate in securing them by one cast of the net, for, in conducting the experiment of artificial impregnation, it appeared to me to be very desirable that the male should be taken, with the female of his own selection, at the very moment when they were mutually engaged in the continuance of their species. To take a female from one part of the stream and a male from another, might not have given the same chance of a successful issue to the experiment. Having drawn the fish ashore, I placed the female, while still alive, in the trench, and pressed from her body a quantity of ova. I then placed the male in the same situation, pressing from his body a quantity of milt, which, passing down the stream, thoroughly impregnated the ova. I then transferred the spawn to the basin, and deposited it in a stream connected with a pond previously formed for its reception. The temperature of this stream was 39°, of the river from which the Salmon were taken 33°, and of the atmosphere 36°. The skins of the parent Salmon are now in my possession.

" On examining the ova on the 23rd of February (fifty days after impregnation), I found the embryo fish distinctly visible to the naked eye, and even exhibiting some symptoms of vitality by moving feebly in the egg. The temperature of the stream was at this time 36°, and of the atmosphere 38°. On the 28th of April (one hundred and fourteen days after impregnation), I found the young Salmon excluded from the egg, which was not the case when I visited them on the previous day. The temperature of the stream was then 44°. The ova, which for some time previous to being hatched, had been almost daily in my hand for inspection, did not appear to suffer at all from being handled. When I had occasion to inspect the ovum, I placed it in the hollow of my hand, covered with a few drops of water, where it frequently remained a considerable time without suffering any apparent injury. The embryo, however, while in this situation, showed an increased degree of activity by repeatedly turning itself in the egg, an action probably produced by the increase of temperature arising from the warmth of the hand.

"On the 24th of May (twenty-seven days after being hatched), the young fish had consumed the yolk, but in a few days afterwards the whole of this family, with the exception of one individual, were found dead at the bottom of the pond, a circumstance which has occurred more than once in the course of my experiments, arising, I apprehend, from a deposition of mud, the same result having previously taken place, when the pond had not been sufficiently imbedded with gravel.

"To show the effects of increased temperature in hastening the development of the infant fish, I may relate an experiment which I made upon a few of the same ova, from which this family proceeded. On the 20th of April (one hundred and six days after impregnation), finding the ova alluded to unhatched, and the temperature of the stream being 41°, I took four of them and placed them in a tumbler of water, covering the bottom with fine gravel, in which I imbedded the ova. I then suspended the tumbler from the top of my bed-room window, above which I placed a large earthenware jar, with a small spigot inserted in its side, from which I easily directed a stream of pure spring water into the tumbler. The waste water was carried out at the window along a wooden channel fitted up for the purpose. As there was no fire in the bed-room, and the window facing the north, the temperature did not range very high, 47° being the average, while the average temperature of the water in the tumbler was 45°. During the night, however, the temperature would be very considerably increased, and the consequence was, the young fish in the tumbler were hatched in thirty-six hours, while those remaining in the stream did not hatch till the 28th of April, a difference of nearly seven days. At this stage the little fish are so very transparent, that their vital organs are distinctly visible, and, when placed immediately under the eye of the observer, they present a very interesting appearance. The pectoral fin is continually in rapid motion, even when the fish itself is otherwise in a state of perfect repose. They also begin to manifest an increasing desire to escape observation, a principle wisely implanted for their better security, during so feeble and helpless a condition. On the 24th of May (thirty-nine days after their birth), the fish in the tumbler were completely divested of the yolk, and the characteristic bars of the Parr had become visible. At this time they measured nearly one inch in length, and appeared to be in perfect health; but fearing that after the yolk was consumed, I should be unable to supply them with appropriate food, I returned them to the pond from which I had taken them on the 20th of April, where they perished with the rest of the family.

" This last experiment proves, that by placing the ova under a temporary stream of water in the house, the development of the young may be materially accelerated, while it also shows that they may be kept alive for a considerable time afterwards; at all events, until the yolk, which I presume to be their sole support at this period, is totally consumed.

" The next experiment, the circumstances of which I have to relate, has been attended with more success than those which I had previously made. The process of taking the adult fish, and all the circumstances of attending the impregnation, were entirely similar in this case to that already narrated.

" That the pedigree of the young fish may not be called in question, I have preserved the skins of the parents. The weight of the male when taken was sixteen pounds, and of the female eight pounds.

" The spawn was impregnated and deposited in the stream immediately below the fall, pond No. 1, on the 27th of January, 1837 ; the temperature of the water in the stream being 40°, and that of the water in the river 36°. On the 21st of March (fifty-four days after impregnation), the embryo fish were visible to the naked eye. On the 7th of May (one hundred and one days after impregnation), they had burst the envelope, and were to be found amongst the shingle of the stream. The temperature of the water was at this time 43°, and of the atmosphere 45°. It is this brood which I now had an opportunity of watching continuously for a length of time, that is, for more than the entire period which was required to elapse from their exclusion from the egg, until their assumption of those characters which distinguish the undoubted Salmon-fry. I therefore desire, even at the risk of repetition, to describe their progressive growth during these important and usually misconceived stages of existence. But before doing so, I beg to be indulged in a few miscellaneous remarks.

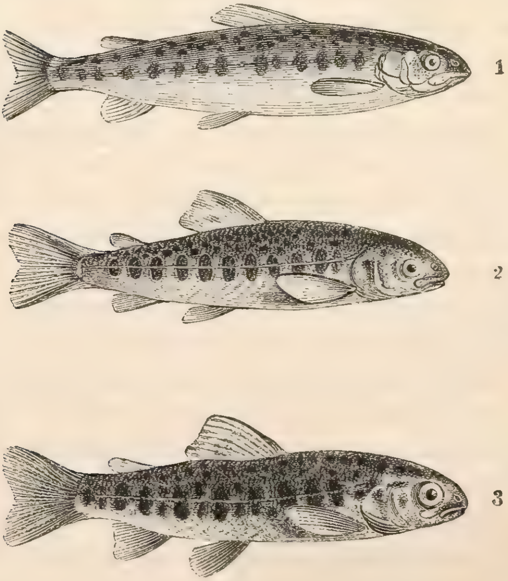
" It is indeed in no way surprising that any body of scientific men, before whom a portion of these observations on the growth of the Salmon in fresh water may have been previously laid, should have been slow to express a decided opinion on the subject, more especially when the result of my experiments goes to prove facts so opposed to what has been the received opinion both of scientific and practical observers, ever since the natural history of the Salmon became a subject of inquiry. I have no wish to attempt removing these opinions by the substitution of others which may be equally destitute of a correct foundation, but by the statement of facts resulting from the most careful and repeatedly verified experiments—experiments which, I believe, have been made by no other individual on the same principle for a similar purpose; for had they been so, I am persuaded the real history and economy of this valuable and interesting fish would long ere now have been more correctly understood by the community. However, should similar observations have been made, the results of which tend to support any material facts contradictory of those here stated, it would be most desirable that the scientific public should be immediately apprised of them.

" It has been asserted, with some appearance of truth, in support of the old school theory, that owing to the comparatively limited range of my experimental ponds, that the young Salmon reared in them have not had a 'supply of food sufficiently varied, or in sufficient quantity, to insure an equally rapid growth to those in the open river.' This objection, I must repeat, is by no means tenable, as the streams and ponds in which they have existed from their birth abound with every species of insect food peculiar to the river, and, at the same time, the fishes themselves (which are certainly the best test), are in the highest possible health and condition, and correspond in every respect with those in the river. I have already stated that the young of the Salmon remain in the river for the first two years after their birth, being then known under the various local denominations of Parrs, Pinks, Fingerlings, &c. However, in order to prevent any misconception of the terms employed in the course of these details, I shall adhere to the name *Parr*, as being the designation by which this fish is most generally known in Scotland.

" The early or late hatching of the Salmon-spawn in the river is no doubt in a great measure regulated by the temperature which may prevail after its deposition. In severe winters, when the temperature of the river for many weeks barely exceeds the freezing point, the ova remain in the gravel at the bottom of the stream during that period with the living principle comparatively suspended, until the more genial temperature of the spring brings that principle into more active operation. In the course of experiments made in the beginning of 1838, I had an opportunity of observing the different effects of temperature in facilitating or retarding the development of the Salmon-spawn. In ova placed in a stream of spring water, the average temperature of which was 40°, the embryo fish was visible to the naked eye by the end of the sixtieth day, and was hatched on the hundred and eighth day after impregnation. That which the same parent deposited the same day in the river, the average temperature of which during the eight following weeks did not exceed 33°, was not visible to the naked eye until the ninetieth day, and was not hatched until the 10th of May,—that is, one hundred and thirty-one days after impregnation. The temperature of the river, however, during the last forty days of that period, had considerably increased, and on the day on which the fishes were hatched, it had attained an elevation of 60°. Were it, then, the fact that the young Salmon migrate to the sea the same season they are hatched, the effects of a mild or a rigid winter would alone regulate the period of their departure from the river. This, however, is not the fact, as the main body of the Salmon-fry regularly quit our rivers about the first or second week in May, whatever may have been the temperature of the previous winter, and in this particular instance they were actually descending the river in shoals on the very day (10th of May) on which that season's produce were only emerging from the ova.

"Owing to the great family likeness which is known to exist amongst the young of the several species of the genus *Salmo* in their early stages, an idea has been entertained that unscientific observers are in the practice of confounding the progeny of the whole of the migratory species indiscriminately under the too general name of *Parr*. To obviate this inconvenience, and to mark the distinction of species in their earlier stages, recourse has been had to very fanciful and ill-defined attributes; and I am of opinion that in almost every instance these vague characters have been applied to individuals of the young of the real Salmon, of which the characters had not been so fully developed as those of others, rather than to the young of any distinct species. With the view, therefore, of affording scientific men an opportunity of comparing the young of the *Salmon Trout* with that of the Salmon, with which they are supposed to have been confounded, I have taken this opportunity of laying before the Royal Society a brood of the former produced by artificial impregnation, and exhibiting five successive stages, from the day on which they were hatched to the age of *nine months*, accompanied by the skins of the parent fishes. At the age of six months they bear no very marked resemblance to the young of the real Salmon either in the Parr or fry state, and as they advance in age and size, the resemblance becomes still slighter. However, on comparing them with the common Trout, the resemblance is very striking, the general outline of the fish being much less elegant than that of the young Salmon or Parr, the external markings being also more peculiarly those of the Trout species, so that, in the absence of the parent skins, it would be a matter of difficulty to determine to which kind of Trout they actually belong. A specimen of the young Common Trout of this season's produce, taken from the *Clyde above the Falls*, is also exhibited; so that the young of the three species most common to this locality (and of corresponding age), viz. *Salmo salar*, *Salmo trutta*, and *Salmo fario*, may be carefully compared. The ova of the *Salmo eriox*, which is less common in these tributaries, I have not as yet had an opportunity of experimenting upon.

" To resume my history of the so-called Parr. Having brought the series of experiments on the ovum of the Salmon, begun in January 1837, to a satisfactory conclusion, it may be gratifying to those who have taken an interest in this curious inquiry, to be put in possession of the results. I



1. Young Salmon. 2. Young Sea Trout. 3. Young River Trout.

have already detailed the particulars regarding the mode practised in capturing the parent Salmon, the process of fecundating the ovum artificially with the milt from the male, and the appearance it presents from that period up to the exclusion of the young fish from the capsule of the ovum, which took place on the 7th of May,—one hundred and one days after impregnation. A complete series of specimens from the egg until the commencement of the third year, illustrates the following descriptive notes.

" Specimens taken from the pond, when ten days old (16th of May), had still a considerable portion of the vitelline bag attached to the abdomen. Specimens removed when forty-eight days old (24th of June) had no recognisable bag, but the symmetry of the form was as yet but imperfectly developed. After the lapse of two months (7th of July) the shape was found to be materially improved, and to exhibit in miniature much of the form and proportions of a mature fish. At the age of four months (7th of September) the characteristic marks of the *Parr* were clearly developed. Two months later (six months' old, 7th of November) an accession both of size and strength was apparent, and on comparing the pond specimens with the Parr of the river, no marked difference was perceptible. The average length at this time was three inches.

" During the winter months, the general temperature of the rivers is so low, and the consequent deficiency of insect food so great, that the whole of the Scottish *Salmonidæ* which inhabit the fresh waters during that season, are well known to lose, rather than gain, in point of condition. The same rule holds in regard to the young Salmon in the experimental ponds, although not to the same degree, they having maintained comparatively a superior condition throughout the winter to those found in the river of a corresponding age and size. The temperature of the ponds, averaging about 40°

during the winter, not only keeps the young fishes which occupy them in a more active condition, but the insects themselves are also more abroad, and thus afford a convenient supply of food not to be obtained by those at that time in the river, the average temperature of which, in ordinary winters, barely exceeds 34°."

"A specimen twelve months old, taken from pond No. 1, on the 10th of May, 1838, is much improved in condition, as well as in external appearance, in comparison to those taken in February, and has exchanged its dusky autumnal and winter's coating for that which may be called its summer dress.* It measures about three inches and three quarters in length, and is denominated, along with those of a corresponding age and size in the river, the '*May Parr*.' Immediately after the migration of the two-year old Parr (which the latter always effect about the beginning of May, under the name of Salmon-fry), there is no other Parr, besides such as have been recently hatched, to be found in the river save those which correspond with this specimen, which is the Pink of the river Hodder, alluded to by Mr. Yarrell.† As the summer advances they increase in size, and are actually the little fish which afford the angler in Salmon rivers so much light amusement with the rod, during the months of August, September, and October. They remain over the second winter in the river, during which period the males shed their milt, and are found continuing their kind along with the female adult Salmon, although still bearing all the external markings of the Parr, as I shall afterwards more particularly mention. A specimen eighteen months old, taken from pond No. 1, on the 14th of November, 1838, measures six inches in length, and has now attained that stage when all the external characteristic markings of the Parr are strikingly developed, and, in point of health and condition, cannot be exceeded by any taken from the river. All the males, at the age of eighteen months, of the several broods in my possession, last autumn (1838) attained a most important corroborative stage, viz. that of showing a breeding state, by having matured the milt, which could be made to flow freely from their bodies by the slightest pressure of the hand. The females of the same broods, however, although in equal health and condition, did not exhibit a corresponding appearance in regard to the maturing of roe. The male and female Parrs in the river, of a similar age, are found respectively in precisely a corresponding state, which may surely be admitted as most important evidence in support of the fact, that all these individuals are, in truth, specifically the same.

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* "On the approach of autumn, the whole of the *Salmonidæ*, resident as well as migratory, while in fresh water, acquire a dusky exterior, accompanied by a considerable increase of mucus or slime. The fins also become more muscular. However, on the return of spring, they resume their wonted beautiful colouring, and the fins, the cartilaginous portions of which are frequently damaged during the winter floods, grow up and acquire their former outline.

† "'Pinks in the river Hodder, in the month of April, are rather more than three inches long, and are considered to be the fry of that year; at this time Smolts of six inches and a half are also taken.'"—See Yarrell's *Supplement to British Fishes*, page 6. The *fry* of the same year, in mild winters, are only quitting the gravel in April, at which stage they measure not more than one inch.—J. S.

" A specimen, two years old, taken from pond No. 1, on the 20th of May, 1839, is six inches and a half long, and *has assumed the migratory dress.* The commencement of the change, which was perfected by the whole of the broods about the same time,* was first observable about the middle of the previous April, by the caudal, pectoral, and dorsal fins assuming a dusky margin, while, at the same time, the whole of the fish exhibited symptoms of a silvery exterior, as well as an increased elegance of form. The specimen in question, so recently a Parr, exhibits a very perfect example of the Salmon-fry or Smolt.

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* " One or two of each of the three broods assumed the migratory or Smolt dress at the age of twelve months. This circumstance I am disposed to attribute to the high temperature of the spring-water ponds, which I have no doubt has hastened the change. I am greatly strengthened in this opinion by the fact of no instance of a similar change having occurred with individuals reared in similar ponds supplied with water from a rivulet, the temperature of which throughout the year ranges pretty nearly with that of the River Nith.

" When the migratory change takes place in the young Salmon in the ponds, a marked alteration also occurs in their habits. While in the Parr state, they show no disposition to congregate, but each individual occupies a particular station in the ponds, and should any one quit his place with the view of occupying the position already possessed by another, the intruder is at once expelled with an apparent degree of violence. But so soon as the whole brood has perfected the migratory dress, they immediately congregate into a shoal, and exhibit an anxious desire to effect their escape, by scouring all over the ponds, leaping and sporting, and altogether displaying a vastly increased degree of activity."

" I have elsewhere stated that ' the circumstances attending the developement and growth of the brood in pond No. 3, so exactly correspond with those of the preceding brood in pond No. 1, that their history would only be a repetition of the former. I may, however, state, that the individuals in pond No. 3 are considerably larger than those in pond No. 1, the difference, at the age of six months, amounting to an inch.' This superiority in point of size, for the first six months, of those in pond No. 3 over those reared in pond No. 1, was not, however, maintained, with the exception of two individuals, much beyond the first six months, as by the period at which they assumed the migratory dress (two years), no difference existed in regard either to size or condition."

" The circumstance of the male Parrs with the milt matured, and flowing in profusion from their bodies, being at all times found in company with the adult female Salmon while depositing her spawn in the river, and the female Parrs being in every instance absent, suggested the idea that the males were probably present with the female Salmon at such seasons for a sexual purpose. And to demonstrate the fact, I, in January 1837, took a female Salmon weighing fourteen pounds from the spawning bed, from whence I also took a male Parr weighing one ounce and a half, with the milt of which I impregnated a quantity of her ova, and placed it in the stream of pond No. 2, where, to my great astonishment, the process succeeded in every respect as it had done with that which had been impregnated by the adult male Salmon, and exhibited, from the first visible appearance of the embryo fish up to their assuming the migratory dress, the utmost health and vigour. The very extraordinary results of these experiments, although made with the utmost possible care, induced me to defer giving them publicity until I had repeatedly verified the fact. I, therefore, removed this brood to another pond, apart from all other fish, where they had an abundant supply of insect food and wholesome water; and again, early in the following January (1838), I repeated the experiment by taking another female Salmon, weighing fourteen pounds, and two male Parrs from the same spawning bed, and impregnated two lots of her ova with the milt from the two Parrs, and afterwards placed them in two different streams, inclosed in boxes open at the top, temperature 45°. The extreme severity of the weather which succeeded had, however, nearly proved fatal to the whole. On the evening of the 8th of January, the day on which I took the parents from the river, the frost set in, and continued with such intensity for a succession of many weeks, that the wild fowl generally, and the wild ducks in particular, suffered severe privations, and in the course of their wanderings in search of food they unfortunately stumbled on my boxes of ova, one lot of which they wholly devoured, to the amount at least of five hundred. My feelings of mortification and disappointment on the discovery of this unforeseen disaster may readily be conceived. However, on examining my other box, I found there were still a few remaining, which I carefully collected, and put into a place of greater safety. The progressive growth of these, from the impregnation of the ova up to the age of eighteen months, has also been uniformly the same as those produced by male and female adult parents, and reared under similar circumstances.

" As a further illustration of the singular economy of the Salmon in their native streams, I have yet to detail another experiment or two, not less interesting than conclusive. In December last (1838) I took a female Salmon from the river weighing eleven pounds, and four male Parrs from the same spawning bed. After impregnating four different lots of her ova, one lot to each individual Parr, I placed the four Parrs in a pond, where they remained until the following May, at which period they assumed the migratory dress. The ova were placed in streams to which no other fish had access, and where they became mature in a similarly progressive manner to those already detailed, thus clearly demonstrating that the young Salmon of eighteen months old, while yet in the Parr or early state, actually perform the duties of a male parent before quitting the river.*

" While the males of the three several broods which occupy ponds Nos. 1, 2, and 3, continued in a breeding state, which lasted throughout the whole of the winter of 1838-39, I impregnated the ova of three adult female Salmon from the river with the milt of a male taken from each of the three ponds, the whole of which ova matured. This at once removes any doubt which may have been entertained regarding the constitutional strength of individuals reared under such circumstances.

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* " As I believe it has been objected to my views, or rather practice, regarding this mode of impregnation, that the generative influence may have been in some other way effected than through the medium of the Parr, I therefore took every means to prove the truthful results of my experiments by varying in some measure their conditions. Thus, in two instances, I took a portion of the ova from a female Salmon, and placed them, *without impregnation*, in a stream of pure water. The result was as I anticipated :—up to the termination of the general hatching season they exhibited no appearance of vitality. The female from

" One of the males used in the above experiments is itself the produce between a male Parr and female adult Salmon taken from the river on the 4th of January, 1837, and reared in pond No. 2, as already mentioned. The result of the experiment practised with this specimen and the female Salmon from the river, being of the utmost importance in establishing the identity of the species (on a principle recognised by physiologists as a law of nature), every necessary precaution to avoid error or confusion was observed. It was taken from pond No. 2 on the 5th of January, 1839, being then twenty months old, with the milt flowing from its body. A female adult Salmon weighing twelve pounds was taken at the same time from the river, in the act of spawning in the absence of the male. A quantity of her ova was impregnated in the same manner in every respect as practised in the preceding experiments, and, for the better security of the lot, the whole was placed in a wooden trough, over which a sheet of fine copper-wire gauze was fixed. The trough was then placed in a stream of water previously prepared for its reception, and the results were precisely of a corresponding nature to those already detailed, the embryo fish becoming visible after fifty-five days, and being excluded from the egg at

which one lot of ova was taken, and placed in water without impregnation, was the female with which the four Parrs above alluded to were spawned. They were placed in the same stream but in a separate vessel from the four lots impregnated. The other lot was taken from the female with which the male from pond No. 3 was spawned. The unimpregnated lot was placed in the same stream with the former. The impregnated lot was placed in the stream of pond No. 3. To avoid contact the unimpregnated lots were in each case taken first, and removed to a distance.

the end of one hundred and nine days after impregnation, under a temperature of 40°.

" It has been maintained by individuals whose opinions are opposed to mine on this question, that the Parr is a distinct species, and that, by a forced connection between it and the female Salmon, I was producing a *hybrid.* This idea at once brings the importance of the last experiment more immediately into view, from the circumstance of the male parent of the specimen being actually a Parr, while the alleged hybrid, in its turn became the parent of a numerous brood.

" Were these two species, then, really distinct, it would follow that the produce would be *hybrids*, and ' nature herself has provided against the confusion of different species by a conservative law, according to which all hybrids are barren :' consequently, upon this principle—a law in the economy of nature—the *Parr* and Salmon are really identical in species, as proved by the fact now narrated, of the young produced between them having actually the power of reproducing their kind.

" Apart from these experiments, it was at one time held, that the Parrs found in their native streams were hybrids, from the anomalous circumstance of the males being always found in the autumn with the milt matured, while females, of a corresponding size, could at no season be found exhibiting the least approximation to a breeding state.* However, this idea, if it ever was seriously entertained by scientific men, has now given way to the opinion 'that they are a distinct species, and have no connection whatever with the migratory Salmon.'* Were the Parr a distinct species, the result of their attendance on the female Salmon would have the effect of producing universal confusion among the migratory inhabitants of rivers, from the circumstance of the male Parrs in a breeding state occupying in great numbers the very centre of the Salmon spawning bed, while the female Salmon herself is at the same instant pouring thousands of her ova into the very spot where they are thus genially congregated.

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* " Solitary instances have occurred of large female Parrs having been found in Salmon rivers with the roe considerably developed, and I find, by detaining the female Smolts in fresh water until the end of the third winter, that individuals are found in this comparatively mature condition. From this fact, therefore, it may be inferred, that the large Parr, either male or female, of nine and ten inches in length, which are occasionally found in rivers, are the young of the Salmon, which, for some natural reason, had not been prepared to migrate at the ordinary period, and had, therefore, remained for another year in the fresh water.

"Had these extraordinary results proceeded from a solitary experiment, there might have been some ground for believing that I was probably deceiving myself, and, consequently, misleading others,—a fear I myself at first entertained. But after such a series of experiments, made with all possible care, and uniformly ending in the same results, the fact can no longer, I conceive, admit of doubt. Having altogether within these last two years, made eight distinct experiments by artificially impregnating the ova of the Salmon with the milt of a corresponding number of male Parrs from the river, besides three experiments with those of eighteen-month-old Parrs from the pond—each with perfect success—I trust that I have thrown some interesting light on *the breeding of Parrs*,—a subject which has hitherto defeated all inquiry when sought after on the principle of their breeding among themselves as a distinct species.

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* "Recent experiments having been made on the young of the Salmon by very competent individuals, it is now admitted that they 'remain *one year* in the river before they go to the sea as Smolts.' However, owing to these fishes having escaped the observation of those individuals during the intermediate stage, that is, from the ovum up to the length of three inches, they were actually twelve months old at the commencement of the experiments referred to by Mr. Yarrell, in place of being the 'fry of that year.'"—See Mr. Yarrell's *Supplement to British Fishes*.

" The fact of the young Salmon propagating its kind while it is yet itself in other respects in an immature condition, is certainly an extraordinary departure from the ordinary laws of nature, so far, at least, as land animals are concerned. From certain observed facts, however, there is reason to believe that the economy of the class of fishes differs in this respect from that of land animals—a disparity which, in consequence of the medium they inhabit, has hitherto escaped the observation of the naturalist. As the young of the other migratory species do not quit the river during the first year, it is probable that they also observe a similar economy to that of their more valuable congener.

" It has been generally supposed that the male Salmon, during the spawning season, assists the female in forming the spawning bed. This idea is, I think, founded in error, as, during the whole course of my experience, I have never been able to detect the male taking any share whatever in the more laborious portion of these parental duties. The only part he performs, beyond the mere sexual function, consists in the unwearied vigilance which he exhibits in protecting the spawning-bed from the intrusion of rival males, all of which he assiduously endeavours to expel. The female, regardless of the occasional absence of the males during these contests, and probably satisfied with the presence of the male Parrs, proceeds with her operations by throwing herself at intervals of a few minutes upon her side, and while in that position, by the rapid action of her *tail*,* she digs a receptacle in the gravel for her ova, a portion of which she deposits, and, again turning upon her side, she covers it up by a renewed action of the tail,—thus alternately digging, depositing, and covering ova, until the process is completed by the laying of the whole mass, an operation which generally occupies three or four days. In the course of these experiments, it has been ascertained that the milt of a single male Parr, whose entire weight may not exceed one and a half ounce, is capable, when confined in a small stream, of effectually impregnating all the ova of a very large female Salmon. On the spawn first quitting the body of the female, it is found to be enveloped in a thin coating of viscous matter, which the action of the water does not immediately destroy, but which continues to admit of a partial adherence to the gravel at the bottom of the spawning bed, where the ova receives the necessary fecundation of the milt, and are afterwards covered with gravel by the instinctive efforts of the female parent, in the manner above described.

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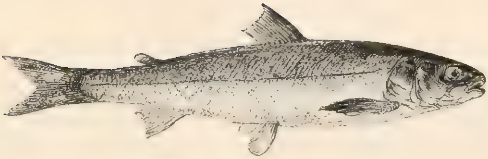
* I am aware it has been a matter of dispute amongst observers as to which of the two extremities of the fish is employed in the formation of the spawning-bed. However, from late opportunities of observation, which rarely occur, owing to the turbid state of the river in the spawning season, I am now satisfied that it is by the action of the caudal extremity alone that the gravel is removed.

" How long these ova will remain excluded from the body of the female, and yet continue capable of receiving with effect the fecundating action of the milt, I have not hitherto ascertained. I have, however, made several experiments on the ova after the parent had been a considerable time dead, and removed from the river. In one particular instance, the female had been dead for nearly two hours without the vital principle of the spawn being in the least degree affected,—as, on being afterwards placed in water, and the milt of a living male poured upon it, it exhibited within the usual period the same healthy and progressing vivification, under a similar temperature, as that taken and impregnated the moment it quitted the body of the living parent. I have merely stated this fact as being in part corroborative, so far as relates to the Salmon, of similar experiments made by M. Jacobi on individuals of the same genus.

" The extraordinary nature of the experiments made with the Parr and Salmon, I have no doubt will tend to stagger the belief of many who may be disposed to admit the truth of the facts resulting from the experiments upon the adult fishes. Nevertheless, they are strictly true; and I would strongly recommend that all those interested should immediately turn their attention to a subject so curious in a zoological point of view, and so important in its bearings on the history of the most highly prized of all the species which ever sojourn in our river waters."

It will be recollected, then, from these details, commencing with the observations of Dr. Knox, that the young Salmon was believed by some to go down to salt water when only two or three months old, or in its first spring. By others it was considered that the young fish did not go down to the salt water till it was fourteen months old, or in its second spring; and the experiments of Mr. Shaw go to prove that they do not go down to the salt water till they have completed their second year, and are in their third spring. If Mr. Shaw is correct that a Pink of three inches and a half in the month of April is twelve months old,—which there is now from his various experiments no reason to doubt,—it will be found that Mr. Parker's observations, commencing with Pinks from the Hodder in April, then twelve months old, subsequently corroborate the views of Mr. Shaw both as to growth and colour.

To return to the Salmon when in a natural state. The adult fish having spawned, being out of condition and unfit for food, are considered as unclean fish. They are usually called Kelts; the male fish is also called a Kipper, the female a Shedder, or Baggit. With the floods of the end of winter and the commencement of spring they descend the river from pool to pool, and ultimately gain the sea, where they quickly recover their condition, to ascend again in autumn for the same purpose as before; but always remaining for a time in the brackish water of the tide-way before making either decided change; obtaining, it has been said, a release from



certain parasitic animals, either external or internal, by each seasonal change; those of the salt water being destroyed by contact with the fresh, and *vice versâ*.

The fry are observed to collect in small pools and mill-dam heads preparatory to quitting the river. The specimen from which the figure on the page was taken was obtained in the Thames, in which river they are occasionally caught in the season, with other fry of *Salmonidæ*, by fishermen who work at night with a casting-net on the gravelly shallows for Gudgeons to supply the London fishmongers.

My own specimens of the young of the Salmon having been preserved in spirits, and the colours thereby affected, the following description is from Dr. Heysham's Catalogue before referred to, premising that some differences in colour may be expected in specimens from different rivers.

"Length seven inches and a half; circumference three inches and one-eighth: head dark green; gill-covers fine silvery white, marked with a dark-coloured spot; belly and sides up to the lateral line of the same silvery colour; back and sides down to the lateral line dusky, inclining to green; sides above the lateral line marked with numerous blackish spots; along the lateral line, and both a little above and beneath it, several dull obscure red spots: dorsal fin has twelve rays, marked with several blackish spots; pectoral fin has twelve rays, of a dusky olive colour; ventral fin eight rays of a silvery white; anal fin ten rays of the same colour. When the scales were carefully taken off with a knife, the obscure red spots became of a fine vermilion, and were nineteen in number; and ten obscure oval bars of a dusky bluish colour appeared, which crossed the lateral line. In a young fry these bars are very distinct."

Whether the river be considered an early or a late river, the descent of the fry is said to take place much about the same time in all. It begins in March, and continues through April and part of May. The Smolt, or young Salmon, is by the fishermen of some rivers called a Laspring; and various couplets refer to the fish, as well as to the time and circumstances under which the descent is made.

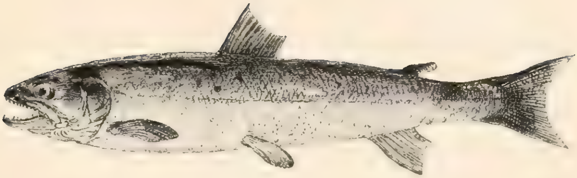
The *last spring* floods that happen in May,
Carry the Salmon fry down to the sea.

And again,

The floods of May
Take the Smolts away.

But the uncertainty of popular or provincial names is a source of great perplexity to the naturalist. The Laspring of some rivers is the young of the true Salmon; but it must also be recollected that the fry of two other species probably descend to the sea about the same time as those of the Salmon.

The Salmon fry at first keep in the slack water by the sides of the river; after a time, as they become stronger, they go more towards the mid-stream; and when the water is increased by rain, they move gradually down the river. On meeting the tide, they remain for two or three days in that part where the water becomes a little brackish from the mixture of salt water, till they are inured to the change, when they go off to the sea all at once. There, their growth appears to be very rapid, and many return to the brackish water, increased in size in proportion to the time they have



been absent. Fry marked in April or early in May have returned by the end of June weighing from two to three pounds and upwards. The London markets during the latter part of June, and the months of July and August, exhibit young fish varying in weight from two to six pounds. I have one, here figured, that weighed only fifteen ounces, which, judging from its appearance when I bought it, that it had been to sea, is the smallest specimen I have ever seen that had been once to salt water.

These small-sized fish, when under two pounds' weight, are called by some of the London fishmongers Salmon-Peal; when larger, Grilse. These fish breed during the winter; they return from the sea with the roe enlarged; the ova in a Grilse being of nearly the same comparative size as those observed in a Salmon, but they mature only a much smaller number. The Grilse visit the estuary, remaining for a considerable time in the brackish water, afterwards in the tide-way above, ultimately pushing up to the sources of the tributary streams, and, as before observed, rather earlier in the season, in the same river, than the more adult fish.

It has been a constantly received opinion, that all the young fish after their first visit to the sea return to the rivers in which they had been bred; and numbers of marked fish are stated to have been retaken in their native rivers:

but it is equally certain that some have been taken in other rivers not far off. The difficulty of supposing that they could find and return to the same spot after roving for miles along the coast remains to be solved. That they do thus rove for miles is proved by the thousands that are taken in nets placed in the bays along the coast. Very many Tweed Salmon have been caught opposite Hopetoun House on the Forth; and a very successful fishing there is generally followed by a scarce one in the Tweed. It is therefore very probable, from the remarks of Dr. Heysham and Sir William Jardine, that if the fish happen to have roved far from the estuary of their native river, they run at the proper season up any stream, even the first they encounter, the temperature and condition of which are congenial to them.

The growth of the Salmon from the state of Smolt to that of Grilse has been shown to be very rapid; and the increase in weight attained during each subsequent year is believed to be equal, if not to exceed, the weight gained within the first. The increase in size is principally obtained during that part of the year in which the fish may be said to be almost a constant resident in the sea. That the food sought for to produce and sustain so rapid an increase of size must be very considerable in quantity, as well as most nutritious in quality, cannot be doubted. That the Salmon is a voracious feeder, may be safely inferred from the degree of perfection in the arrangement of the teeth, and from its own habits, of which proof will be adduced, as well as from the well-known habits of the species most closely allied to it; yet of the many observers who have examined the stomach of the Salmon to ascertain the exact nature of that food which must constitute their principal support, few have been able to satisfy themselves. Dr. Knox states, "that the food of the Salmon, and that on which all its estimable qualities, and, in his opinion, its very existence, depend, and which the fish can obtain only in the ocean, he has found to be the ova or eggs of various kinds of echinodermata, and some of the crustacea. From the richness of the food on which the true Salmon solely subsists, arises, at least to a certain extent, the excellent qualities of the fish as an article of food. Something, however, must be ascribed to a specific distinction in the fish itself: for though he has ascertained that the Salmon-Trout lives very much in some localities on the same kind of food as the true Salmon, yet under no circumstances does this fish acquire the same exquisite flavour as the true Salmon."

That they occasionally, however, take other food, is also well known. Faber, in his Natural History of the Fishes of Iceland, remarks, " The common Salmon feeds on small fishes, and various small marine animals." Dr. Fleming says, " Their favourite food in the sea is the Sand Eel;" and I have myself taken the remains of Sandlaunce from the stomach. Sir William Jardine says, " In the north of Sutherland a mode of fishing for Salmon is sometimes successfully practised in the firths, where Sand Eels are used as bait: a line is attached to a buoy or bladder, and allowed to float with the tide up the narrow estuaries. The Salmon are also said to be occasionally taken at the lines set for Haddocks, baited with Sand Eels. At the mouths of rivers they rise freely at the artificial fly within fifty yards of the sea; and the common earth-worm is a deadly bait for the clean Salmon. All the other marine Salmon are known to be very voracious; and there is nothing in the structure of the mouth or strong teeth of the common Salmon, to warrant us in supposing that there is any material difference in their food." The following is an extract from a letter sent me by Sir William Jardine, dated St. Boswell's, 15 April 1835: — " The fisherman who rents this part of the Tweed, fishing with worm one day last week, had his hooks and tackle taken away by a fish. He put on a new set, and again with worm in ten minutes hooked and killed a Salmon with his former hooks and bait in his mouth. This will either prove extreme voracity, or little sensibility in the parts of the mouth. I have often heard fishermen mention a similar fact, but never before knew an instance on which I could depend."

Several observers have borne testimony to the partiality of the Salmon to the Sandlaunce as food; and I have a record by an angler of Salmon caught in the Wye with a Minnow. In a prize essay published in the Transactions of the Highland Society, vol. ii. page 392, Mr. Alexander Morrison says, "I have taken Salmon, within flood mark, some of which had two, and others three, full-sized Herrings in their stomachs."

The London season of 1835 was more than usually remarkable for large Salmon. I saw ten different fish varying from thirty-eight to forty pounds each. A notice appeared in the public papers of one that weighed fifty-five pounds; and, from the inquiries made, there is reason to believe most of these large-sized Salmon were sent from the Tay. Salmon, however, of much larger size have been occasionally taken. Mr. Mudie has recorded one of sixty pounds. In a note to the history of the Salmon in several editions of Walton, one is mentioned that weighed seventy pounds; Pennant has noticed one of seventy-four pounds: the largest known, as far as I am aware, came into the possession of Mr. Groves, the fishmonger of Bond-street, about the season of 1821. This Salmon, a female, weighed eighty-three pounds; was a short fish for the weight, but of very unusual thickness and depth. When cut up, the flesh was fine in colour, and proved of excellent quality.

The Salmon of the largest size killed by angling, of which I have been able to collect particulars, are,—In the Thames, October 3, 1812, at Shepperton Deeps, Mr. G. Marshall, of Brewer-street, London, caught and killed a Salmon with a single gut, without a landing-net, that weighed twenty-one pounds four ounces.

Sir H. Davy used occasionally to visit the Tweed for the sake of angling for Salmon. This river is famed for affording amusement to the Salmon-fisher, more especially from the middle of March to the beginning of May. "We have heard," says Mr. Stoddart, in his Art of Angling as practised in Scotland, "that on one occasion Sir H. Davy happened by good fortune to hit upon an immense fish, weighing about forty-two pounds, immediately above Yair-bridge, and captured him after a severe struggle. This feat he makes no mention of in his Salmonia, although certainly worthy of some notice."

Mr. Lascelles, in his Letters on Sporting, Part I. Angling, says at page 21, "The largest Salmon I ever knew taken with a fly was in Scotland: it weighed fifty-four pounds and a half."

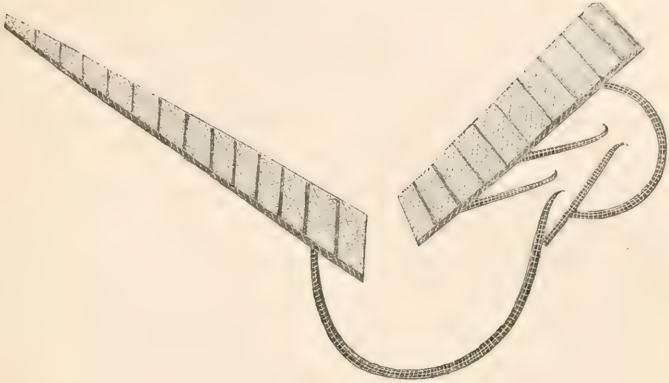
Sir Hyde Parker with a rod and line killed a Salmon in Sweden that weighed sixty pounds; and the Earl of Home, the uncle of the present Earl, killed a Salmon in the Tweed with a rod which weighed sixty-nine pounds and three quarters.

It may be stated generally, that Salmon pass the summer in the sea, or near the mouth of the estuary: in autumn they push up rivers, diverging to the tributary streams; in winter they inhabit the pure fresh water, and in spring descend again to the sea. The question has frequently arisen, Could Salmon be preserved permanently in fresh water? and from the facts already adduced, it appears that they might, but not without some diminution in size or quality, or both.

Mr. Lloyd, in his Field Sports of the North of Europe, vol. i. p. 301, says, "Near Katrineberg there is a valuable fishery for Salmon, ten or twelve thousand of these fish being taken annually. These Salmon are bred in a lake, and, in consequence of cataracts, cannot have access to the sea. They are small in size, and inferior in flavour. The year 1820 furnished 21,817."

It remains to describe the different modes by which the Salmon are taken; and these are as various, and the fisheries are as numerous and as extensive, as the value and quantity of the fish would lead us to expect. The rights of the proprietors, which have arisen in various ways, some by royal grants, others by possession or occupation of the soil, are generally farmed or hired at a rent depending on the extent or value of the local stations. The first attack made upon the fish is in the summer months, when the Salmon rove along the coast in quest of the mouths of the different rivers, in which they annually cast their spawn. "On these expeditions, the fish generally swim pretty close to the shore, that they may not miss their port; and the fishermen, who are well aware of this coasting voyage of the Salmon, take care to project their nets at such places as may be most convenient for intercepting them in their course."

"It so happens that Carrick-a-rede (the rock in the road), between Ballycastle and Portrush, eastward of Ballintoy, is the only place on this abrupt coast (the northern coast of the county of Antrim) which is suited for the purpose. The net is projected directly outward from the shore with a slight bend, forming a bosom in that direction in which the Salmon come. From the remote extremity of the net a rope is brought obliquely to another part of the shore, by which the net may be swept round at pleasure and drawn to the land: a heap of small stones is then prepared for each person. All things being ready, as soon as the watchman perceives the fish advancing to the net, he gives the watchword. Immediately some of the fishermen seize the oblique rope, by which the net is bent round to enclose the Salmon, while the rest keep up an incessant cannonade with their



ammunition of stones, to prevent the retreat of the fish till the net has been completely pulled round them; after which they all join forces, and drag the net and fish quietly to the rocks."*

Pursuing a course along the shore and arrived at an estuary, on each side of the mouth, and for miles up on both sides, stake-nets are used, of which the engraving above represents the form. The distance between high and low water mark on the shore is the site occupied. The shallow extremity of the net on the left hand in the figure, which is fixed and supported by stakes, is placed on the shore at high-water mark; the deepest part of the net, at low-water mark; the concavity of the sweep of the net between its two ends, called the court, being opposed or open to the flood-tide running up the river, the Salmon which in their passage up along-shore strike against any part of the net are conducted by its form through the chambers into the trap, from whence they can find no retreat.

Many fish, in the wide part of the estuaries, ascending with each flood-tide and returning with the ebb, it is not unusual to have stake-nets placed in the reverse position, with the courts open to the ebb-tide, on purpose to meet this disposition in the Salmon; and they do actually sometimes catch as many fish in their downward as in their upward course.

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* Letters concerning the Natural History of the Basalts on the Northern Coast of the County of Antrim, by the Rev. William Hamilton, A.B.

The central portions of the streams, many of which are very wide, are worked incessantly by fishermen in boats called cobles, with long sweeping seine-like nets. Another mode of fishing is with a net dropped into the water from the stern of a boat, as the boat is rowed away from the shore. Men are stationed at particular places near the river, where the water is shallow, to watch the fish coming up; and so habituated are they to this, that they can discover by a ripple on the surface of the water even a solitary fish making his progress upward. When a fish is thus discovered, an alarm or signal is instantly given to the men at the shiel or house where the fishermen lodge: and immediately a boat is rowed off by one man with great celerity, having a net attached to it, and ready prepared for dropping gradually into the water, one end of which is tied to the boat, and the other is dragged with a rope by men on shore; and by taking a considerable sweep, an endeavour is made to surround the fish. When thus discovered coming up, they seldom escape.

Higher up the river, and in parts that are narrow, weirs or dams are built across the stream. At certain intervals along these weirs, cruives are placed. Cruives are enclosed spaces formed in the dam wall; the fish enter these spaces, through which the water rushes, as they push up the stream, and are prevented by a grating of a peculiar contrivance from returning or getting out. All the wide and open pools of the river between these artificial, or any other natural contractions of the stream, are fished with the coble and sweep net.

In the work by the Rev. William Hamilton already quoted, and in the second series of Mr. Jesse's Gleanings in Natural History, an interesting account is related of the assistance afforded by a water-dog to some Salmon fishermen when working nets in shallow pools. The dog takes his post in a ford or on a scour where the water is not very deep, and at a distance below the net: if a Salmon escapes the net, the fish makes a shoot down the river in the direction towards the sea: the dog watches and marks his approach by the ripple on the water, and endeavours to turn the fish back towards the net, or catch him; if he fails in both attempts, and the fish passes him, the dog then quits the water, in which the pace of the fish is too fast for him, and runs with all his speed down the bank of the river to intercept the fish at the next shallow ford, where another opportunity and a second diverting attempt occurs.—I learn also from Mr. Bicheno, that dogs are occasionally used when trying for Salmon in that part of Glamorganshire where he now resides. These dogs appear to take great pleasure in the pursuit, exhibiting by turns the most patient watchfulness, persevering exertion, or extraordinary sagacity, as either quality may best effect the wishes of the master. In some parts of Wales, where the rivers are narrow, and the Salmon are caught in a net drawn by men on each bank, dogs are trained to swim over from side to side with the head and ground lines of the net, as required. From a correspondent in Devonshire I learn that a clever poacher at Totness on the Dart, admitted that he had killed many Salmon in the night by setting a trammel, or three-wall net, at the lower end of the deep pools in the river Dart, and by sending in a Dog at the upper end of the pool, which dog he had trained to dive like an otter. The Salmon, as soon as the dog dived, immediately dashed down the stream, and were taken in the trammel-net at the lower end of the pool.

Sir Walter Scott, in his novels of Redgauntlet and Guy Mannering, has described with his well-known skill and effect the animated scenes which occur when parties are engaged in spearing Salmon either by daylight or torchlight, as practised in the North. These works are familiar to all, and repetition would be useless. For the following description of two other modes of taking Salmon I am indebted to the kindness of Dr. Richardson.

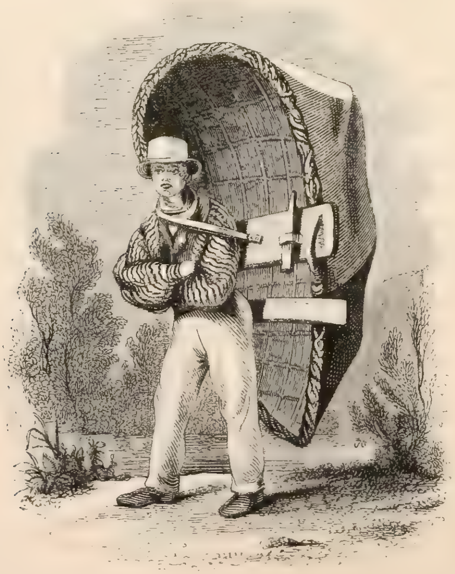
A particular kind of fishing is peculiar to the Solway Firth, or at least can be practised with success only where the tide flows, as it does there, over extensive flats. The instrument used is termed a "halve," and consists of a funnel-shaped net ending in a pocket or bag. The mouth of this net is stretched on an oblong frame about three yards wide, to which there is attached a handle or pole. When the tide begins to flow, a number of fishermen proceed over the sands, and range themselves in a close line across the current of the flood, each with the "halve" resting on the bottom, and its pole against his shoulder: as the tide rises, it becomes too deep for the man farthest from the shore, who then raises his net and places himself at the other extremity of the line, where he is shortly succeeded by another and another, the whole thus changing places continually. When a fish strikes the halve, its mouth is instantly elevated above the surface by the fisherman, so as to prevent its retreat until it can be carried into shallow water and secured. During the ebb a similar plan is pursued in a reversed order; the mouths of the nets are still turned to the current, but the fishermen now move in turn to the end of the line which stands deepest in the water. Flat-fish are the principal returns of this fishing; but prime Salmon are occasionally taken both on the flood and ebb.

This kind of fishing being as yet open to all, and unfettered by parliamentary enactments, there is scarcely a cottage on the shores of the Solway Firth where the halve-net may not be seen suspended. The fishermen have all some other employment by which they maintain their families, being mostly artisans ; and they generally consume the produce of the halve-net at home, unless they chance to take a fish whose value is sufficient to compensate them for the time spent in going to market, sometimes ten or twelve miles distant.

Somewhat akin to this is the Salmon fishery in the Frith of Forth. Narrow stages or platforms, supported on wooden pillars, are carried from the shore for a considerable distance into the river. Upon each of these half-a-dozen or more fishermen station themselves with bag-nets, which are dropped down from the side of the stage with the current of the tide. The owner concealed, and also sheltered by a straw hurdle, such as is used in decoys for water-fowl, watches his net, and on a fish being taken, instantly secures it. When the tide ebbs, the net is shifted to the opposite side of the stage.

"A singular method of taking Salmon is practised at Invermoriston, in the county of Inverness, where the river flows in a narrow chasm between two projecting rocks. The fisherman seats himself on a cleft of this rock, right over the cascade, with a spear in his hand, which has a line fixed to the upper end of the shaft, similar to the practice of fishing for whales with harpoons. Whenever the Salmon makes a spring to gain the ascent over the cataract, the spearman strikes the fish and lets the shaft go, holding only by the line until the fish has exhausted his strength ; then the spear and fish are thrown ashore by the stream, and taken out at the lower side of the pool."

The mode of fishing for Salmon in the Severn, and other rivers of Wales, with coracles and nets, requires a short and concluding notice. The coracle is a small boat constructed with willow twigs in the manner of basket work, or with split slips of elastic wood, both the form and the material varying in different counties. In the neighbourhood of Shrewsbury, the framework is covered with canvass and painted; in Cardiganshire it is covered with flannel, and afterwards with a coating of tar. The boat is something less than six feet long, and about four feet wide, with a seat across the middle. The form of the paddle with which this little boat is impelled and guided along is also varied: in the Severn, the blade is square, but a more elongated blade is the form in use on the Dee. The boat, which in appearance is not unlike one half of a walnut-shell, is so light and portable that the fisherman carries it to and from the water on his back. These coracles,* so called, it is said,



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* This word is sometimes written coriacle, and may be derived from *coriago*, hide-bound.

from *corium*, the hide of the beast with which they were formerly covered, are of great antiquity: they were known in Cæsar's time, and are described by Lucan to be very nearly the same as in our own days.

> "With twisted osiers the first boats were made,
> O'er which the skins of slaughter'd beasts were laid;
> With these the Britons on the oceans row,
> And the Venetians on the swelling Po."

The custom of alternately carrying or being carried, as practised by the fisherman and his boat, is whimsically alluded to in the following lines, extracted from an old MS. history of Shropshire.

> "Some sportsmen in pursuit of prey,
> Their horses on their shoulders lay;
> But seizing of their booty, then
> They sit their steeds like other men.
> Returning home when all is o'er,
> Their steeds they carry as before."

The coracle is in frequent request with fly-fishers,* the banks of the rivers being in some places very rugged and steep, in others overgrown with wood to the water's edge.

The fishing for Salmon in coracles is performed by two men, each in his little boat, drawing between them down the stream a single-walled trammel, called there a horn-net, from its sliding by means of rings of horn, instead of corks, along the top. Through these rings runs a line, the end of which is held by one of the fishermen. By pulling upon this running line, which is distinct from the drag-line, the net is quickly closed when a fish strikes it. Various modifications of this sort of net occur in different rivers. Captain Medwin, in his Angler in Wales, says, "We stood on the bridge at Machynlleth for some time, to watch the operations of two fishermen in coracles. They were about to drag for Salmon; and it must have been difficult to preserve the balance in such frail and fragile machines. The net was attached to the two boats, and connected them. When all was clear, the fishermen made with their paddles a considerable circle, and then reunited, drawing in cautiously the sweep. They seemed very dexterous in the management of their canoes, and perfectly unconscious of danger. The first essay was a failure; a Salmon of ten or twelve pounds' weight leaped over the corks."—Long doubly-walled trammel-nets are now in use near Shrewsbury.

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* Hansard's Trout and Salmon Fishing in Wales, pages 145 and 184.

The length of the head of the Salmon, as compared to the whole length of the fish, is as one to five: the eye rather small, placed nearer to the point of the nose than to the posterior edge of the gill-cover: the peculiarities of the teeth and the parts of the operculum have been already described; the origin of the last ray of the dorsal fin about half-way between the point of the nose and the end of the tail; the first two rays simple and shorter than the third, which is the longest and branched; all the other rays of this fin branched; the last ray double, but arising from a single origin, is only counted as one: the posterior edge of the base of the adipose fin is half-way between the origin of the last dorsal fin-ray and the end of the tail, and over the origin of the last ray of the anal fin. The pectoral fin two-thirds of the length of the head; ventral fin in a vertical line under the middle of the dorsal fin, with an axillary scale two-fifths of the length of the ventral fin itself; the anal fin commences about half-way between the origin of the ventral fin and the commencement of the lower caudal fin-rays, the third ray the longest, the first two rays simple, the others branched: the form of the tail has been already noticed. The body is elongated; the dorsal and abdominal line about equally convex; the lateral line near the middle of the body, dividing it equally; the fleshy portion of the tail slender, and ending in the form of one half of a hexagon; the scales moderate in size, oval and thin, easily removed when young, adherent when old. The fin-rays in number are—

D. 13 : P. 12 : V. 9 : A. 9 : C. 19. Vertebræ 60.

Salmon, and indeed all the *Salmonidæ*, like other fish that swim near the surface of the water, cannot be eaten too fresh; its fine flavour, as well as its value, diminish rapidly after capture. In London a Thames' Salmon commands the highest price: the next is that sent up either from Woodmill or Christchurch in Hampshire; then those fish received from the Severn, which are usually brought up by the mail from Gloucester.

A Thames' Salmon is a prize to a fisherman, which, like other prizes, occurs but seldom. The last Thames' Salmon I have a note of was taken in June 1833. The appearance of the Common Tern, or Sea-Swallow, which on its arrival in May wings its flight for miles up the Thames, is the signal to the fishermen to keep a good look-out for a Salmon: the occasionally coincident reappearance of a Tern and a Salmon has induced some of the Thames' fishermen to apply to the former the name of the Salmon-bird.

Soon after the publication of the History of British Fishes the Earl of Home did me the favour to write various comments and notes on the *Salmonidæ* of the Tweed, in the form of a letter to the Earl of Montague, dated January 10, 1837, and has since been kind enough to give me permission to use them. The following refer to the Salmon:—

"Mr. Yarrell is correct as to the time of the spawning of the Salmon in the Tweed. I must, however, be allowed to make a remark on this subject: that in the Tweed a very great change has taken place within these twenty or thirty years: a considerable portion of the breeding-fish not coming into breeding condition till long after the time they had formerly been in the habit of doing so. On the 2nd of November, 1835, I killed, with fly, fourteen Salmon, from ten to twenty pounds' weight, every one of which was in as fine condition as fish caught in the end of July.

" It is singular enough that in the early part of the season, when the first show of young Salmon comes up the Tweed, however small they may be, they are all denominated Salmon. I have killed them under three pounds ; yet that fish was called a Salmon, and the fishermen,—I mean those above Berwick or Norham,—all allege that no Grilses ascend the river till the second great shoal come up about the beginning of June. The Berwick people are, however, now convinced that the Grilse is neither more nor less than a young Salmon, and accordingly call it so.

" I have always considered the Salmon as a sea fish, leaving it for the river for the sole purpose of spawning. That during the period they remain in the fresh water, they are not only nearly stationary as to growth, but lose, and rapidly too, their fine condition, and their flesh its fine and delicate flavour. This I consider chiefly occasioned by their not being able to obtain the more nutritious food of various kinds which they find in the sea.

" The Salmon is no doubt a very voracious feeder at times.

" The first Salmon I ever caught was with the minnow, in the month of June, 1783, when I was a boy of thirteen, fishing for Trout. That fish weighed eighteen pounds ; and since that time I have frequently killed ten or twelve Salmon in one day with a minnow ; the worm also is a very deadly bait, when the river gets low in summer, and in the upper parts of the river the worm is the principal bait used during the whole of the spring fishing season. In the summer, too, numbers of Salmon are caught with the parr tail.

" I have often known a Salmon Kelt take away a set of minnow-tackle, consisting of three large hooks at least, and caught with another set as soon as it could be put on; but the instances of clean Salmon being so caught are very rare.

" During the latter part of last season, 1836, there were more Salmon in the river than I ever remember to have seen, with the exception of one season, about twenty years ago, and certainly a much greater proportion of very large fish by far than I can remember.

" I observed many oversetting, (the term used when Salmon jump out of the water for their own amusement,) which must have weighed from thirty to forty pounds, and one which I am sure must have exceeded fifty pounds at least. I never saw so large a fish in our streams. It is a curious fact that on both these occasions, when there were such multitudes of fish, they would not take any fly or bait that could be offered to them: some few were caught, no doubt, but only here and there one; and this was more or less the case the whole way from the foot of Gala-water down to my fishing-ground, where I may say the rod-fishing ends. I may here mention that I have killed, and all with the fly, many hundreds of Salmon weighing twenty-five pounds and upwards. The two largest I ever killed weighed, one forty-five pounds, in July 1795, the other forty pounds. The latter fish was sent to the late Duke of Buccleugh, at Bowhill. When his old cook saw the fish he declared it was absolutely impossible that any man could kill such a fish with the rod, and to this moment does not believe I caught it. The fish, which weighed forty-five pounds, killed also in the month of July 1795, was a fresh run fish, with what are called tide-lice on it, and the finest I ever tasted.

" My uncle, my father's elder brother, caught a Salmon with a rod which weighed sixty-nine pounds and three-quarters.

" For a number of years, however, there has been a great scarcity of large fish in the river, few exceeding eighteen pounds having been caught, and my present fisherman told me he had never seen a clean Salmon above twenty pounds. The reason for this scarcity of large fish was, first, the river down at Berwick was over-fished; and secondly, all the large spawning-fish were killed during close time by poachers in the upper parts of the river, particularly in the small streams to which the fish resort in such numbers to deposit their spawn. Of course very few were allowed to return to the sea, and consequently few of the old or large fish could return to the river the next season.

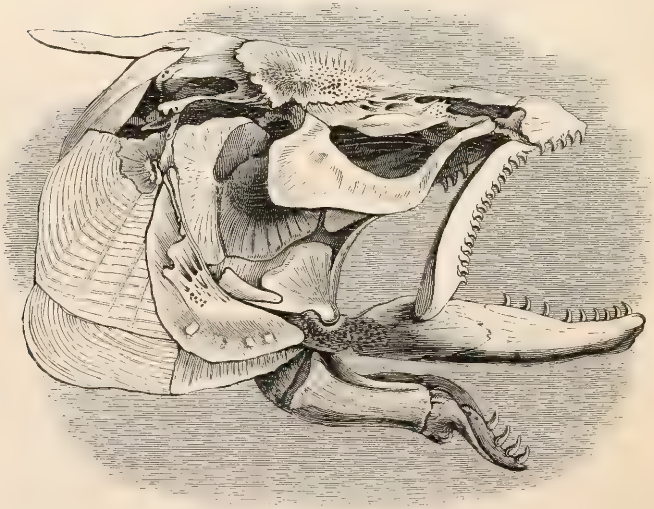
" I may here be permitted to mention that in the month of April 1795, I killed thirty-six Salmon in one day, rod-fishing, one of which, eighteen pounds, I took home. Mr. Yarrell may form some idea of the size and quality of the fish when I tell him that the fisherman received twenty-five guineas for that day's work, not including the fish I took home. The day after, I caught twenty-six.

" In the month of June of that year, 1795, I killed in one week, between the Monday morning and Saturday night, eighty-two clean Salmon, all in the finest condition, and many of them large fish, which averages near fourteen per day, all but two Salmon.

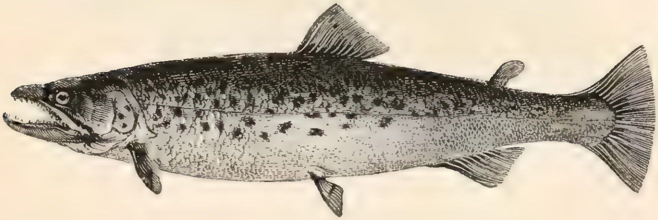
" But, alas ! those halcyon days in Tweed are ended ; rod-fishing is all but entirely over, and is now reduced to a few days in spring and a few days in autumn, when the net-fishing ends on the 15th of October. This change has been brought about by draining the sheep farms on the hills, the effect produced being that a little summer flood which took a fortnight or three weeks to run off previous to 1795, is now completely run out in eight hours. The rain which formerly filled the bogs or sides of the hills, and which then kept giving a constant and regular supply to the river, is now carried off at once by these drains to the different feeders, causing sudden and violent floods, and short as they are sudden, so that the flood is all run off before the river has had time to clear itself, too low for a Salmon to rise, and not clear enough to see hook, even were there Salmon to take one. But the worst effects produced by these drains, and consequent diminution in the volume of water, is the advantage it gives to the fishermen below, near the mouth of the river, who now hardly allow a fish to escape, and indeed in summer the river becomes so low that it cannot clear itself, as a quantity of filth and sludge is constantly floating backwards and forwards with the flood and ebb tides, which prevent the Salmon taking the river at all. Sir Humphrey Davy in his Salmonia compares the Tweed as it was formerly to what it is now, to two houses, the one covered with thatch, and the other with slate; the one dripping for hours after rain has fallen, the other ceasing when the rain ceases. In short, Salmon-fishing in the Tweed is quite at an end; except in some particular years when there is rain enough to ruin the crops and create almost a famine in our harvest time, September, but that is all. What I regret also, almost as much as the loss of Salmon-fishing, is our Trout-fishing,—that, too, is at an end. Last year, 1836, we had not one single opportunity, and in 1835, it was much the same; for, of course, the draining has affected the smaller streams as well as the Tweed itself.

"My uncle, the same who caught the seventy pound Salmon, had a Newfoundland dog which was celebrated for catching Salmon. He knew the Monday mornings as well as the fishermen themselves, and used to go to the cauld or mill-dam at Fireburn mill on those mornings. He there took his station at the cauld slap, or opening in the dam, to allow the Salmon to pass, and has been known to kill from twelve to twenty Salmon in a morning. The fish he took to the side. The then Lord Tankerville instituted a process against the dog. I had a copy of the proceedings, but I regret to say it was lost when the old library was altered. This case was brought before the Court of Session, and the process was entitled, the Earl of Tankerville, versus a Dog, the property of the Earl of Home. Judgment was given in favour of the dog."

The vignette below represents the bones of the head in the Salmon.



ABDOMINAL MALACOPTERYGII. *SALMONIDÆ.*

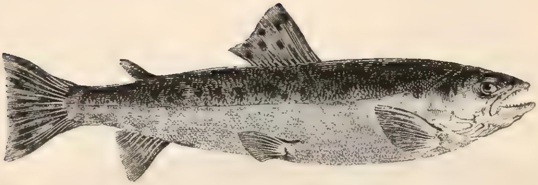


THE GREY TROUT. = S. trutta

THE BULL TROUT, OR ROUNDTAIL.

Salmo eriox, LINNÆUS.
,, *cinereus aut griseus,* WILLUGHBY, p. 193.
,, *griseus seu cinereus,* RAY, p. 63, A. 3.
,, *eriox,* *Grey,* PENN. Brit. Zool. vol. iii. p. 394.
,, ,, ,, FLEM. Brit. An. p. 180, sp. 46.
,, ,, ,, JENYNS, Brit. Vert. p. 422.

THE GREY TROUT is distinguished from the Salmon and Salmon Trout by several specific peculiarities. The gill-cover differs decidedly in form, as examination of the central figure of the illustration at page 5 will show. The operculum is larger; the free vertical margin much more straight; the inferior posterior angle more elongated backwards; the line of union with the suboperculum not so oblique, but nearly parallel with the axis of the body of the fish: the inferior edge of the suboperculum parallel to the line of union with the operculum: the interoperculum



much deeper vertically; the vertical edge of the preoperculum more sinuous. The teeth in the Grey Trout are longer and stronger than those of the Salmon; but, like the Salmon, the two or three teeth that may be seen on the vomer in the adult fish occupy the most anterior part only. The tail becomes square at the end in this species at an earlier period than in the Salmon; and the central caudal rays continuing to increase with age, the posterior edge from being concave becomes convex. The Warkworth Trout and Coquet Trout of Northumberland and Durham are the young of the Grey Trout.

The Grey Trout, in all its stages of growth, is probably better known in the Tweed than elsewhere: it is there as abundant as the Salmon. I have had proof of the existence of this species in some of the rivers of Dorsetshire and Cornwall: it occurs in the estuary of the Severn, and I have seen it from the rivers of South Wales. Dr. Heysham includes this fish among those of the rivers of Cumberland that run into the Solway. Sir William Jardine, Bart. mentions it as occurring sometimes in the Annan in Dumfries-shire. Mr. Low says it is found in the loch of Stenness, Orkney. In Ireland this species occurs on every side of the northern portion of the island, but its distribution in other parts is yet to be determined.

The Grey Trout appears to be the *Salmo maculis cinereis caudæ extremo æquali* of Artedi, page 23, sp. 2; and probably also, as quoted, the *Graia Salmo cinereus seu griseus* of Willoughby and Ray, whose specific names have precedence of *eriox*. This fish sometimes attains the weight of twenty pounds; but it more commonly occurs under fifteen pounds' weight. It ascends rivers for the purpose of spawning, in the same manner as the Salmon, but earlier in the season; and the fry are believed to go down to the sea sooner than the fry of the Salmon. This species affords good sport to anglers; and, from its great muscularity, it is a powerful fish when hooked, frequently leaping out of the water. It is not, however, held in the same degree of estimation as food as the Salmon or Salmon Trout: the flesh, even when the fish is in season, is paler in colour, yet its quality as food may depend on the particular stream in which the fish has been caught. Sir Walter Scott says, " There is an old rhyme, which thus celebrates the places in Liddesdale, remarkable for game:

> 'Billhope braes for bucks and raes,
> And Carit haugh for swine,
> And Tarras for the good bull-trout,
> If he be ta'en in time.'

The bucks and roes, as well as the old swine, are now extinct; but the good Bull Trout is still famous."—*Notes to the Lay of the Last Minstrel, Canto IV.*

The following are the notes of Lord Home on this fish: —

" The Bull Trout has increased in numbers prodigiously within these last forty years, and to that increase I attribute, in a great measure, the decrease of Salmon Trout, which formerly abounded when I was a boy. It is now a rare thing to see a Salmon Trout or Whitling,—for the Whitling in the Tweed was the Salmon Trout, not the young Bull Trout, which now go by the name of Trouts simply. The Bull Trout take the river at two seasons. The first shoal come up about the end of April and May. They are then small, weighing from two to four or five pounds. The second, and by far the more numerous shoal, come late in November. They then come up in thousands, and are not only in fine condition, but of a much larger size, weighing from six to twenty pounds. The Bull Trout is an inferior fish, and is exactly what is called at Dalkeith and Edinburgh, Musselburgh Trout. Mr. Yarrell is mistaken when he says these fish afford good sport to anglers; quite the contrary: a clean Bull Trout, in good condition, is scarcely ever known to take fly or bait of any description.* It is the same in the Esk at Dalkeith. I believe I have killed as many, indeed I may venture to say I have killed more Salmon with the rod, than any one man ever did, and yet put them all together I am sure I have not killed twenty clean Bull Trout. Of Bull Trout Kelts, thousands may be killed. The great shoal of these Bull Trout, not taking the river till after the commencement of close time, are in a great measure lost both to the proprietor and the public."

The description is taken from an adult male of thirty-two inches in length, from which the cut at the head of this article was drawn and engraved.

The length of the head compared to that of the body only is as one to four; the teeth and the form of the parts of the gill-covers have been already described; the elongation of the under jaw is peculiar to the males only, but is not in the Grey Trout so conspicuous as in the Salmon; the dorsal fin commences half-way between the point of the nose and the origin of the short upper caudal rays; the base of the dorsal fin longer than the longest of its rays: the adipose fin large, and nearer to the end of the tail than to the origin of the last dorsal fin-ray; the form of the tail at different ages has been noticed; the length of the pectoral fin very little more than half the length of the head. The scales of the Salmon are thin in substance, oval, with numerous concentric lines only: the number of scales forming an oblique line from the lateral line up to the base of the anterior part of the dorsal fin, following the oblique arrangement of the scales, about twenty; and the number in a row from the axillary scale of the ventral fin up to the lateral line about eighteen. The scales of the Grey Trout are rather smaller than those of the Salmon in fish of equal size, the number forming a continuous oblique row from the lateral line up to the base of the dorsal fin being about twenty-six; the number of those forming a row from the ventral axillary scale up to the lateral line, whether taking the line that ascends obliquely forward or backward, is about twenty-five; the axillary scale of the ventral fin nearly half as long as the fin itself: the anal fin nearer the tail than in the Salmon; all the fins muscular.

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* A mistake as to season, or time of year, not of the species.

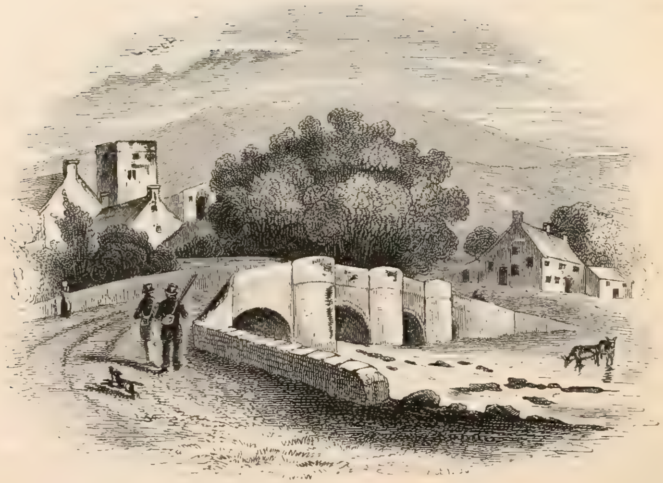
The fin-rays of this Trout in number are—

D. 11 : P. 14 : V. 9 : A. 11 : C. 19. Vertebræ 59.

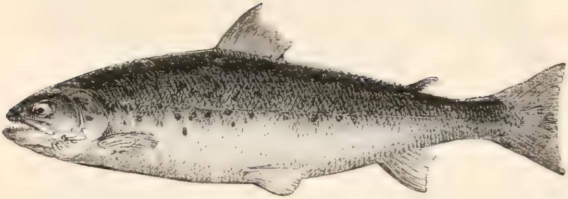
In six specimens out of seven, the number of vertebræ was fifty-nine; in the other, sixty. Fifty-nine will probably prove to be the normal number in the Grey Trout.

The form of the body of this fish is similar to that of the Salmon, but the nape and shoulders are thicker, the fleshy portion of the tail and the base of each of the fins more muscular: the males are the stronger in the water, but the females are the more eager for bait, and their teeth are rather smaller. The colours of the males in the spawning season are — the head olive brown, the body reddish brown or orange brown, that of the females a blackish grey ; the dorsal fin reddish brown, spotted with darker brown ; the tail dark brown ; the other fins dusky brown. The general colour at other times like that of the Salmon Trout.

The vignette below is a view of Rothbury Bridge, over the Coquet, looking from the south.



ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.*



THE SALMON TROUT.

Salmo trutta,	LINNÆUS.	
Trutta salmonata,	WILLUGHBY, p. 193.	
,, ,,	*Salmon Trout,* RAY, p. 63.	
Salmo trutta,	BLOCH, pt. i. pl. 20, adult.	
,, *schiefermulleri,*	,, pt. iii. pl. 103, young.	
,, *trutta,*	*Sea Trout,*	PENN. Brit. Zool. vol. iii. p. 397.
,, *albus,*	*Phinock,*	FLEM. Brit. An. p. 180, sp. 42.
,, *trutta,*	*Sea Trout,*	,, ,, ,, sp. 45.
,, ,,	,, ,,	JENYNS, Brit. Vert. p. 423.
,, ,,	JARDINE'S Illust. Scot. Salm. pl. 11. 3. 10. 9.*	

THE SALMON TROUT is, of the migrating species in this country, the next in value to the Salmon. It is most abundant in the rivers of Scotland, and its flesh is excellent. It is distinguished by the gill-cover being intermediate in its form between that of the Salmon and the Grey Trout. The representation on the right hand of the vignette at page 5 is that of the Salmon Trout male. The posterior free margin, it will be observed, is less rounded than that

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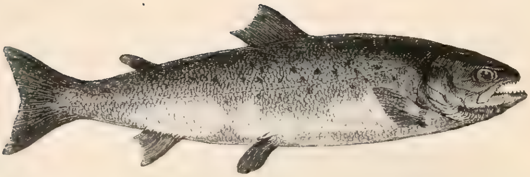
* The numbers of the plates are here arranged according to the age of the specimens figured.



of the Salmon at the left hand, but more so than that of the Grey Trout, which is represented by the middle figure. The line of union of the operculum with the suboperculum, and the inferior margin of the suboperculum, are oblique, forming a considerable angle with the axis of the body of the fish. The posterior edge of the preoperculum rounded, — not sinuous, as in the Grey Trout. The teeth are more slender as well as more numerous than in the Salmon or Grey Trout; those on the vomer extending along a great part of its length, and indenting the tongue deeply between the two rows of teeth that are there placed, one row along each side. The tail is less forked at the same age than that of the Salmon, but becomes ultimately square at the end. The size and surface of the tail also is much smaller than that of the Salmon, from the comparative shortness of the caudal rays. The figure at the head of this article represents the Salmon-Trout in its fourth year; the second figure represents this species in its third year.

This fish is the White Trout of Devonshire, Wales, and Ireland; it is found in the Severn, in the rivers of Cornwall, and is plentiful in the Esk and the Eden, which communicate with the Solway, where it is called Sea Trout.

The habits of this species are also very like those of the Salmon, and the females are said to run up the rivers before the males. Sir William Jardine says, "In approaching the entrance of rivers, or in seeking out, as it were, some one they preferred, shoals of this fish may be seen coasting the bays and headlands, leaping and sporting in great numbers, from about one pound to three or four pounds in weight; and in some of the smaller bays the shoal could be traced several times circling it, and apparently feeding. In these bays they are occasionally taken with a common hang-net stretched across; and when angled for in the estuaries, with the ordinary flies which are used in the rivers of the South for Grilse, rose and took so eagerly that thirty-four were the produce of one rod, engaged for about an hour and a half. They enter every river and rivulet in immense numbers, and when fishing for the Salmon are annoying from their quantity. The food of those taken with the rod in the estuaries appeared very indiscriminate; occasionally the remains of some small fish, which were too much digested to be distinguished; sometimes flies, beetles, or other insects, which the wind or tide had carried out; but the most general food seemed to be the *Talitris locusta*, or common sand-hopper, with which some of their stomachs were completely crammed. It is scarcely possible to arrive with any certainty at the numbers of this fish. Two hundred are frequently taken at a single draught of a sweep-net, and three hundred have occasionally been counted." They are much more numerous in the Don, the Spey, and the Tay, than in the Tweed.

Great quantities of this Salmon Trout are sent to the London market; those from Perth, Dundee, Montrose, and Aberdeen appear, from their comparative depth of body, to be better fed, are higher in colour, and considered to be finer in flavour than from some other localities. The Fordwich Trout of Isaac Walton is the Salmon Trout; and its character for affording " rare good meat," besides the circumstance of its being really an excellent fish, second only to the Salmon, was greatly enhanced, no doubt, by the opportunity of eating it very fresh. Fordwich is about two miles east-north-east of Canterbury. The stream called the Stour was formerly very considerable ; it communicates with the sea opposite the back of the Isle of Sheppy, and from Fordwich one branch going eastward, again enters the sea at Sandwich. The ancient right to the fishery at Fordwich was enjoyed jointly by two religious establishments: it is now vested in six or seven individuals, who receive a consideration for their several interests. It was formerly the custom to visit the nets at Fordwich every morning to purchase the fish caught during the night. I have seen specimens of the Salmon Trout from the Sandwich river exposed for sale in the fishmongers' shops at Ramsgate, during the season for visiting that watering-place ; and the Salmon Trout is also occasionally taken in the Medway by fishermen who work long nets for Smelts during the autumn and winter. I have obtained a young specimen in the Thames from the men who fish for Shads above Putney-bridge in the months of June and July.

The following are the notes of Lord Home on the Salmon Trout :—" Of this excellent species I can only repeat that in the Tweed they have almost entirely disappeared. These latter afford good sport to the angler; but I never saw one above seven pounds' weight. Of the Phinock of the Spey, the Hirling of the Nith and Annan, the Whitling or Whiting of the Esk, all one and the same fish, I can say nothing. There is a little fish, however, which makes its appearance about November and December, but in very small numbers, few only being caught, and of course with the hook. They are called here Silver Whites, and also Black Tails, from a dusky blue spot in the centre of the tail fin. It is a beautiful little fish, resembling much a small Salmon-Trout, and if not a young Salmon-Trout, I know not what they are. When caught, the scales, which are of a beautiful silvery whiteness, separate so easily from the fish, that on taking it up they stick to the hand, leaving almost the impression behind. The flesh pink-coloured, and the flavour very good."

Dr. Mac Culloch states, that "the Salmon-Trout, or Sea Trout, as it is called in Scotland, is now a permanent resident in a fresh-water lake in the island of Lismore, one of the Hebrides, and without the power of leaving it or reaching the sea. There it has been known for a long course of years, perfectly reconciled to its prison, and propagating without any apparent difficulty."*

The length of the head is, when compared with the length of the body alone, as one to four; the depth of the body compared to the whole length of the fish is also as one to four: the teeth small and numerous, occupying five rows on the upper surface of the mouth; those of the central row on the vomer extending some distance along it, the points turning outwards alternately to each side; one row upon each side of the under jaw, and three or four teeth on each side of the tongue, strong, sharp, and curving backwards, well calculated to assist in holding a living prey, or to convey food towards the pharynx: the middle of the eye situated half-way between the point of the nose and the posterior edge of the preoperculum: the form of the parts of the gill-cover have been already described and figured. The first ray of the dorsal fin is short; the second ray long, equal to the length of the base of the fin; the articulation at the base of the last dorsal fin-ray exactly half-way between the point of the nose and the end of the tail; the fleshy fin on the back being also half-way between the base of the last ray of the dorsal fin and the end of the tail. The body of the fish rather deep for its length; the lateral line very nearly straight, and passing along the middle of the body: the scales adhering closely; in form rather a longer oval than those of the Salmon, and having about twenty-three in the usual line up to the dorsal fin, and twenty-two below it. The fin-rays in number are—

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* Journal of the Royal Institution, No. xxxiv. p. 211.

D. 12 : P. 13 : V. 9 : A. 10 : C. 19. Vertebræ 58.

The upper part of the head and back dark bluish black, becoming lighter on the sides, which are marked with numerous spots, somewhat resembling in form the letter X: these spots are mostly above the lateral line. The lower part of the sides and belly silvery white; cheeks and gill-covers silvery white; the dorsal fin, fleshy fin, and tail, nearly as dark as the colour of the back; the pectoral fin rather small and bluish white; the ventral fins white, arising in a vertical line under the middle of the dorsal fin; the anal fin white, the base of the fin one-third shorter than the longest of its fin-rays. When the Salmon Trout is placed by the side of a Salmon, it is, in comparison, darker in colour in the body, but lighter in the colour of the fins.

The specimens of the Phinock or Hirling of the North, the *Salmo albus* of Dr. Fleming, which I have received, so exactly resemble the young of the Salmon Trout on its first return from salt water that I am unable to point out any sufficiently distinguishing specific character.

The coloured Illustrations of the Scottish *Salmonidæ* by Sir William Jardine, Bart., represent this species, and also the Salmon in various stages of growth.

ABDOMINAL MALACOPTERYGII. *SALMONIDÆ.*

THE PARR.

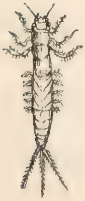
Salmo salmulus, Willughby, p. 192.
,, ,, Ray, Syn. p. 63, sp. 2.
,, ,, Penn. Brit. Zool. vol. iii. p. 404.

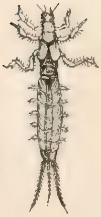
This little fish, one of the smallest of the British *Salmonidæ*, has given rise to more discussion than any species of the genus. Abounding in our Salmon rivers, and conspicuous for those lateral marks which are known to be borne for a time by the young of the Trout as well as the fry of the other *Salmonidæ*, and this fish always appearing of small comparative size, it has frequently been insisted upon as the young of the Salmon; and local regulations have as generally been invoked for its preservation.

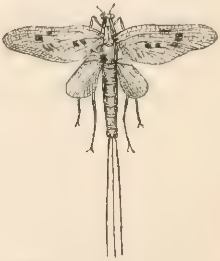
The fry, however, of the different species of migratory *Salmonidæ* are probably even now only known accurately to a few persons: their great similarity when very small, as shown at page 36, has so frequently deceived even those who have lived the greater part of their lives on the banks of Salmon rivers, that the fry marked by them, in their experiments, believing them all to be what they considered the young of the Parr, have been retaken as Grilse, Grey Trout, Salmon Trout, and River Trout. The transverse dusky bars from which this fish has obtained the name of Brandling and Fingerling are family marks, borne by all the species of the genus for a time, and it has been remarked on this subject by the late M. Fries, the Ichthyologist of Stockholm, that the more natural the genus the more difficult it is to characterise the species while young.

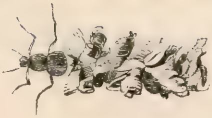
Mr. Shaw's experiments and observations, already given at length in the article on the Salmon, have gone very far towards convincing many that the Parr, as a distinct species, does not exist. Further experiments are in progress by Mr. Shaw and others, and it is hoped their observations will be made public, and the Natural History of our *Salmonidæ* clearly made out.

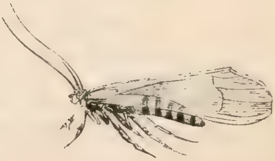
The vignettes below represent three states of the May-fly and two states of the Stone-fly of anglers.



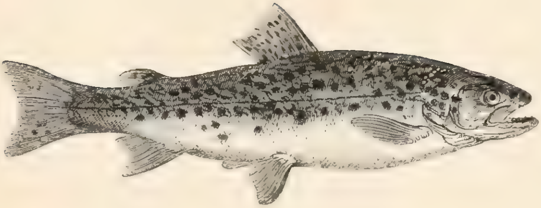








ABDOMINAL MALACOPTERYGII. *SALMONIDÆ.*



THE COMMON TROUT. = S. trutta

Salmo fario,			LINNÆUS.
,, ,,			BLOCH, pt. i. pl. 22 & 23.
,, *Goodenii,*			,, pt. iii. pl. 102.
,, *fario,*	*River-Trout,*		PENN. Brit. Zool. vol. iii. p. 399, pl. 70.
,, ,,	*Trout,*		DON. Brit. Fish. pl. 85.
,, ,,	*Common Trout,*		FLEM. Brit. An. p. 181, sp. 47.
,, ,,	,,	,,	JENYNS, Brit. Vert. p. 424.
,, ,,	,,	,,	JARDINE, Illust. Scot. Salm. pl. 5 & 12.

THE COMMON TROUT is too widely diffused and too generally known to make any enumeration of particular localities necessary; it is an inhabitant of most of the rivers and lakes of Great Britain, and so closely identified with the pursuits and gratifications of sportsmen, that those landed proprietors who possess streams of water favourable to the production and growth of Trout preserve them with great care and at considerable expense. The Trout, though a voracious feeder, and thus affording excellent diversion to the experienced angler, is so vigilant, cautious, and active, that great skill as well as patience are required to ensure success. During the day, the larger sized fish move but little from their accustomed haunts ; but towards evening and during the night they rove in search of small fish, insects, and their various larvæ, upon which they feed with eagerness. The young Trout fry may be seen throughout the day sporting on the shallow gravelly scours of the stream, where the want of sufficient depth of water, or the greater caution of larger and older fish, prevent their appearance.

Though vigilant and cautious in the extreme, the Trout is also bold and active. A Pike and a Trout put into a confined place together had several battles for a particular spot, but the Trout was eventually the master.

The season of spawning with the Trout is generally in the month of October, at which period the under jaw of the old male exhibits in a smaller degree the elongation and curvature observed to obtain in the male Salmon, of which an instance will be shown.

Sir Humphrey Davy in his Salmonia particularly alludes to the experiments of Mr. Jacobs, a German gentleman, on the breeding of Trout by artificial impregnation of the ova. The Rev. Dr. Walker, Professor of Natural History in the University of Edinburgh, thus refers to the experiments of Mr. Jacobs in his paper printed in the second volume of the Transactions of the Highland Society. " He found that in Salmon and Trouts the roe is not fecundated till after ejection. That when both are extracted from dead fishes, the roe by mixture can be fecundated by the milt, and when placed under water in a proper situation can be brought forth into life. He further discovered that this artificial fecundation can be accomplished with the roe and milt of fishes that have been dead two and even three days."

By the kindness of Mr. Pickering, of Chancery Lane, I am enabled to insert here a translation of Mr. Jacobs' paper, which appeared in 1763 in the form of a letter to the editor of the Hanover Magazine.

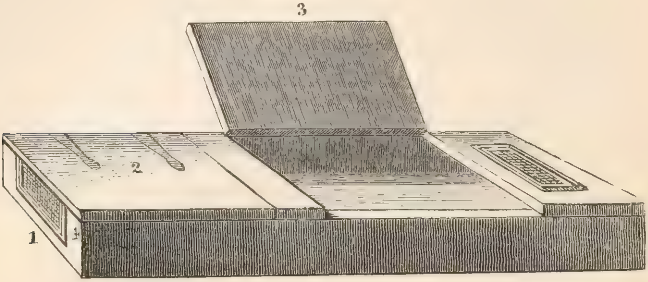
"Sir,—I have thought it a duty incumbent on me to lay my observations on the breeding of Trouts and Salmon, as well as on other subjects, before the public. It would be needless, and not to my present purpose, to mention every trifling experiment which I made within the last sixteen years, before my discovered invention; and in twenty-four years more afterwards, on the artificial increase of Trouts and Salmon, perhaps I may be induced to give a more circumstantial account on this subject. The box, trough, or water-bed in which the eggs, animated with the milk or sperma of the male Trout, are scattered, needs no particular form, yet it will be necessary to give a description how those which I use are made.

"Section I.

"1. I had boxes made of various woods, but I found oak to be the best, of about twelve feet long, one foot and a half wide, and six inches deep.

"2. At the head of the trough where the water is to run in, is laid a thick board about two and a half or three inches thick, about a foot wide, and as long as the trough is wide; in the middle of this board is made a hole six inches long, and about four inches wide in the clear, with a ravet on all the four sides of this hole, about an inch and a half wide and deep, so as to admit a square frame, with an aperture of six inches by four inches, or of the same size as the hole, which frame must be covered with a brass grating of a moderate strength, and close enough to prevent the smallest water-shrew from passing through, otherwise all the spawn and young fry will be in danger of being devoured by them.

"3. Near the middle of this box or trough lay another piece of thick board across, as long as the width of the trough, and about six inches or more wide, which, when nailed upon the edges of the side pieces, will keep them more steady and firm.



" 4. Let the lower end board, where the water is to run off again, be at least three inches thick, as the greatest pressure is against it, have an opening cut at the top six inches wide and four inches deep ; have a ravet made on the outside and another on the inside, deep enough to leave at least an inch thick of the solid board in the middle, and wide enough to admit a frame with a brass-wired grate, like No. 2, on the outside, which can be pushed in from the top ; the wires should not be above a line and a half asunder, no more than those at the top, for the same reason as mentioned before. In the inside, opposite this opening, push a bit of board downwards into the groove to stem the water either entirely or to regulate its running off, according as you find it necessary, or to pull it entirely out when the whole of the water is to run off.

" 5. There must be two strong covers, one between the two cross pieces described in 2, 3, and the other below the middle cross quite to the lower end, 4 ; both covers must be fastened behind with strong hinges, and before with handles, to lift them conveniently up by ; and as these boards are apt to warp, on account of the water within and the air without, it is requisite to have each clamped with two or three cross pieces.

“ 6. If you think fit to give the young fish more air than what enters at the two brass grates, you may have in each cover a hole made of the same size, and guarded with a brass-wire grate, as 3; and for the same reasons, I have done this out of precaution, but have found it, in the end, to be unnecessary.

“ Section II.

“ 1. Spring water out of rocks or stony ground is the properest for breeding of Trout and Salmon; but where it is not to be had, other spring water may do, provided the current is strong enough, so as not to freeze in hard frosty weather.

“ 2. If the spring has not fall enough, you must raise a dam around it, one or two feet higher than the top of your trough; convey the water from thence through a pipe or gutter, to the first grate in the opening, on the head part of the trough, Section I. 2, of one square inch diameter, and determine its length at least two inches above the grate; the remaining water from the spring can be led off sideways.

“ If you have an inclination for more breeding troughs than one, they should be fixed in the same direction as the first, and a larger pipe must be placed to the head of the spring, which must empty itself into smaller pipes, laid across the water troughs, so that each trough may have its proper quantity of water conveyed into it; or it may be managed by means of brass cocks; but this is left to the choice of every one’s own pleasure, as the most convenient method will be soon found out.

“ 3. After the box or trough is properly finished, it must be placed horizontally upon two legs of wood, stone, or brick; and within upon its bottom put some clean washed gravel, about the size of peas and beans, two inches high; afterwards sprinkle some coarse gravel or pebbles over it, the smallest of them of the size of beans, and some larger than hazel-nuts. This last is done, that upon the surface of the smaller gravel many deep holes may be formed, that the continual motion of the water may not carry away the eggs, but that they may remain where they were at first sprinkled in.

" 4. Then let the water run into the trough as directed in 2, and raise it higher or lower, according to the instructions, Section I. 4, so that the water covers the gravel always one or two inches.

" This done, you have accomplished all that is necessary to the apparatus for breeding Trouts and Salmon.

" Section III.

" 1. The time of spawning begins the latter end of November, and commonly ends the latter end of January, or beginning of February. But the spawning time of each separate Trout continues only about eight days, as the eggs of the female and sperma of the male become in some sooner in others later ripe.

" Trouts meet in rivulets in great numbers, in the before-mentioned months, and such as are ready for spawning fix upon a place where there is large gravel, and where the water has a quick current; there they rush and rub their bellies against the stony bottom, and so violent, that they often make great holes; and by means of this motion both female and male get rid of their spawn and sperma.

" As a single drop of sperma contains vast numbers of animalcula sufficient to animate hundreds of eggs, and as the water is loaded at this time with the sperma, it is no wonder that almost every egg becomes a fish.

" Every egg or spawn in the female comes to its perfection and ripeness at the same time and day; but it is not so with the sperma of the male, for the sperma, or white roe, lies like a solid substance divided into two parts in its body close to the back, and grows gradually liquid, and dissolves itself into a creamy fluid, beginning at the lowest part, and discharges about the sixth part of each division every day, so that within eight days all the sperma becomes liquid and runs off.

" Section IV.

" 1. To breed young Trouts, according to this invention, you must have some Trouts taken out of the rivulet in December and January when they gather together to spawn; as in some rivulets their spawn becomes later ripe, you may in the latter end of January let part of the water drain off, by stemming the water above, that you may take as many out as you want; if after stroking their bellies with the fingers, some spawn or sperma goes off, it is a sign that both are ripe, and those must be put into a large pail or tub for use.

" 2. Then take a wooden, earthen, or copper bowl, put into it a pint, quart, or more of clear water; take out of your pail one fish after another, stroke them with the hand or fingers downwards till the spawn discharges into the bowl: you need not fear that it will hurt them, for they can without danger bear great pressing; then rub the belly of the male Trout in the same manner till some of its milk discharges into the water,—a little is sufficient,—then stir the whole with your hand so as to mix it well, and all the eggs and spawn will be fructuated; then mix more clear water with them to disperse them more asunder: after the eggs are impregnated with the sperma they are apt to clog together, which hurts them in the end; it is therefore necessary to thin them with more water, and to sprinkle them into the breeding trough.

" A small space will receive a great quantity of spawn, yet they must not lie too thick, otherwise when many touch each other too closely, they will get in a few days into putrefaction, and have the appearance as if a fine downy wool was spread over them ; if they remain in this state they are unfit. To prevent this, take a thin slice of wood, or a paddle about the breadth of a hand, and paddle with it backwards and forwards on the spot where the spawn lies too thick, to spread by this motion the spawn asunder.

" 3. It will be necessary to repeat this manœuvre twice a week, or at least once a week, and by paddling with your wooden slice in all parts, you will bring the water upon the eggs in motion ; for let the water be ever so clear, there will adhere to the eggs in a few days a subtle filth, which lays the foundation of their corruption, even when the young fish is already alive in the egg ; therefore it is necessary to clean them by this gentle means.

" 4. After the eggs have been about three weeks in this state, one may perceive through the hard skin a divided black spot, which are the eyes of the young fish ; the body is too transparent to be seen with the naked eye, but after four weeks, if you squeeze one of the eggs between your fingers, you will see the fish make a motion and turn within,—then you perceive his form.

" At last, after lying five weeks in this state, and under a continual current of running water, the young fishes will bore their heads through the shell of the egg, and under motion with their bodies will, in about half an hour, free themselves entirely from the shell, with the yolk of the mother egg hanging to their bellies like a small bag ; so soon as they are out of the egg, they will still be in the cavities between the gravel, and have then the appearance as if the head of a pin was fastened to a reddish field pea, on account of these hanging bags. For three or four weeks they receive their nourishment from the substance contained in this bag, till by degrees, as the fishes grow larger, the bag disappears, then they begin gradually to assume the shape of fishes, and having no further sustenance from this bag, they will seek for food themselves. But as in so small a compass as this breeding trough, there cannot be a sufficient quantity of small insects to be found for their sustenance, they seek for more room where they may meet with them in greater abundance; they follow then the current of the water, and slip through the brass grate at the end of the box, where you should have a large wooden tub, like a brewer's cooler, or a small clean fish pond, covered with gravel to receive them, in which they will grow in about six months considerably.

" Section V.

" To instruct my readers as much as possible, I shall add several observations on the formation of these young Trouts.

" 1. After an egg has been fructuated by the sperma of the male, which slips through an invisible opening into it, it lodges in the white liquor under the shell and round the yolk, which last is liquid and transparent, tending to a yellowish colour, and seems to fill up the greatest space in the egg, except the little white round it.

" 2. So soon as this little animalcule has assumed the nature and form of the fish, it appeareth that the yolk in the egg is separated by a very thin skin from the outward hard membrane.

" 3. The fish itself, except the eyes, is very transparent, and as liquid as a little mucilaginous water, yet in shape longish; it lies bent within the outward harder membrane of the egg, and round the thin skin that covers the yolk.

" 4. From this time the fish is to be considered as one body grown to the yolk from the gills downwards to the outlet, which is in length about the quarter part of the inward circumference of the egg ; this yolk, which looks like a bag, becomes the belly, and without entrails.

" 5. On this expanded belly, especially in the Salmon Trout, are plain to be seen many blood-vessels, divided into smaller branches, and so plain, that the arteries may be distinguished from the veins with the naked eye. And it is no wonder, for as it has been mentioned that this hanging belly is larger in proportion to the fish, so the blood-vessels are in proportion expanded, and are to be seen very plainly, so long as the fish remains in a state of transparency like water.

" 6. If you open one of these bags with a needle, a liquor runs out of a yellowish colour, which is the nutriment of the fish, then the bag shrinks in like an empty bladder, and the fish dies.

" After the fish has been out of its egg about a fortnight, a thin skin separates from the inward coat of this hanging belly, and then it shrinks so much that it appears as entirely vanished. After the belly is entirely shrunk to its proportionable size, this inward skin shrinks likewise, and becomes the intestines ; from the mouth it forms a passage into the stomach, and continues more narrowly contracted and formed into intestines which lay one over another to the outlet in the belly.

" It is farther to be observed that the heads of the Trout, when they first have the shape of fishes, have not yet all the usual shape or form,—they look as if the snout was chopped off near the eyes ; but as their bellies shrink, their heads grow, the mouths are formed, and after about three weeks the heads get their proper shape.

" Lastly, I shall make a few additions, which flow from the former observations, and are the result of experiments, which at this present occasion I have no inclination to publish.

" Section VI.

" 1. According to the course of nature, no Trouts or Salmon are generated in ponds or standing waters.

" 2. They cannot be bred there if millions of pregnant eggs were put into them.

" 3. The young Trouts have, in the first two or three weeks, great tenacity of life, for after the head is dead, the body will live two days before they are quite dead; this is to be understood of healthy fish, kept in a current of fresh running water.

" 4. Although the young Trout love to swim with the current within the six weeks out of their breeding trough, yet they can be kept within them six or more weeks longer, by particular management.

" 5. They are not easily caught, on account of their small size and rapid motion, notwithstanding they may be collected in a pail.

" 6. They may then be put into proper water, or can be put through a funnel into bottles, and carried to any part provided the water don't freeze.

" 7. The ripe eggs of a Trout, after they are four or five days apparently dead, and gone into a kind of putrefaction, so that the stench is intolerable, may yet be recovered and bred out into fishes.

" 8. The eggs of Trouts will not produce fishes so long as they remain connected with the egg stock.

" 9. The natural causes, why it is possible that a hen may bring a live chicken into the world may very easily be accounted for, from observations I have made in the breeding of Trouts.

" 10. The natural disposition of the animalcule of the sperma, which enters the egg, may be considerably increased.

" 11. I have made many experiments, in which I found that two animalcules had slipt into the egg, and that double fishes have been generated; and although they had two bodies, they had but one common stomach: how this happens, see Section V. 1.

"12. Of these monstrous productions the most of them were opposite to one another, and had their stomach in common between them: yet, in a strict sense, the stomach only; the rest of the intestines divided in about three weeks separately.

"13. Some of these double fishes were fixed by their sides together, when two animalcules of the sperma enter the egg in a direct line 90 degrees one from another.

"14. I have seen only one of these double fishes where the backs were crossed nearest the tail in a direct angle, so that this fish formed a kind of cross. This happens when two animalcules enter one egg, and are placed opposite each other from their direct line to 90 degrees.

"These monsters, 12, 13, were grown together from the head to the opening in the belly, and that 14 had in some degree a joined body, but the backs were distinguished one from another.

"15. All these kind of monstrous productions die in four or five weeks, after their joint bag or belly is emptied; for as each endeavours to follow its own direction in pursuit of food, and both hinder one another, neither of them is capable of performing its intention; it is impossible that either head can receive its proper nourishment, therefore they must starve.

"16. All monstrous productions in the human and other animal creations, with a joint stomach, are produced when an egg is fructuated by more than one spermatic animalcule.

"17. All observations made on the Trout, and its artificial method of breeding, hold good with regard to Salmon.

(Signed) "S. L. Jacobs."

The Trout varies considerably in appearance in different localities; so much so, as to have induced the belief that several species exist. It is, indeed, probable that more than one species of River Trout may exist in this country; but when we consider geologically the various strata traversed by rivers in their course, the effect these variations of soil must produce upon the water, and the influence which the constant operation of the water is likely to produce upon the fish that inhabit it;—when we reflect also on the great variety and quality of the food afforded by different rivers, depending also on soil and situation, and the additional effect which these combined causes in their various degrees are likely to produce;—we shall not be much surprised at the variations both in size and colour which are found to occur. That two Trout of very different appearance and quality should be found within a limited locality in the same lake or river, is not so easily explained; and close examination of the various parts which afford the most permanent characters should be resorted to, with a view to determine whether the subject ought to be considered only as a variety, or entitled to rank as a species. In these examinations the character of the internal organs also, and the number of the bones forming the vertebral column, should be ascertained. The normal number of vertebræ in *Salmo fario*, our Common Trout, I believe to be fifty-six.

The remarks of Lord Home on the Common Trout are as follows:—"I am much inclined to think there is but one kind of River Trout; the large Lake Trout may be different, but of that I can be no judge, having never caught or seen them; but to the variation in size, colour, and appearance of the River Trout I can speak. It has often happened to me, when fishing in the height of the season for Trout in Tweed, that, out of two or three dozen I have caught, there should be five or six differing not only from the common Tweed Trout, but from each other. The reason of this difference in my opinion is easily explained. These Trout come down into the Tweed during the winter and spring floods from its different feeders, viz. the Ettrick, Yarrow, Jed, Kale, Eden, Leet, &c.; all differing completely from each other. These Trout retain enough of their original appearance to distinguish them from Tweed Trout, which, with the exception of the Whitadder Trout, are the leanest and worst-flavoured of any in this part of the country; but, after a few months' stay, these Trout from the small burns gradually lose their original marks and excellence of flavour, and become like the common Tweed Trout in every respect. There can be no doubt that the nature of the soil through which the different streams flow is the cause of the difference of appearance, not only as to colour and size, but also particularly in the superior excellence of their flesh to that of the Tweed and Whitadder Trout. For example, the Eden and Leet, flowing through a rich loamy and often marly soil, afford Trout of very superior size and quality; their bodies beautifully marked with bright red spots, their fins orange-coloured, as well as their sides, and their flesh fully a deeper red than that of the Salmon, and almost as high-flavoured, particularly the Leet Trout, which I have killed weighing seven pounds. The largest Tweed Trout I ever saw was one I caught with a salmon-fly: it weighed just five pounds.

"There are two considerable streams in this county which take their rise at no great distance from each other, the Whitadder and the Blackadder, the latter tributary to the former. The Whitadder from head to foot flowing along a very rocky and gravelly bed; while the Blackadder (Blackwater) rises in the deep mosses near Wedderlea and the Dorrington laws (High hills), and flows for about half its course through mosses; the rest of its course through a rich and highly cultivated district. The Trout of Whitadder (Whitewater) are a beautiful silvery fish, but good for nothing; those of the other, dark, almost black, with bright orange fins, and their flesh excellent. Nothing can be more different than the appearance of the Trout of these two rivers; and surely nothing can be more easy than at once to see the cause of this difference. The Trout in neither of these streams are of a great size. In the Blackadder they would attain a large size, — say three or four pounds; but the river is overfished, and poached to perfection.

"I have ascertained that the Tweed Trout, after having been a month or two in the Leet, change their colour, and soon assume the appearance of those of the Leet: while, again, not only the Leet Trout, but those of the other small burns, soon lose their beauty and other good qualities after they have been any time in the Tweed. I may mention that the food in the two little rivers Leet and Eden afforded the Trout, is the principal cause, in my opinion, of their superior size and excellence. This food consists of small shells, cadis bait, &c. and clouds of flies produced by the marl on the sides of the brooks and the woods on their banks.

"Once, while fishing in the Tweed for Trout with minnow, a Trout rose and missed. I threw the minnow over him at least twenty times; each time the fish rose eagerly, and made the most unfishlike (if I may use the expression) attempts to seize the minnow; at last a tail-hook took hold of him, and I got him out. It proved to be a Trout with the upper jaw formed exactly, or very nearly, like that described in the 59th page of vol. ii.; and resembling as near as possible the vignette at the bottom of that page.* This Trout was lank and thin, but weighed a pound and a half. Unluckily I did not preserve it."

Sir William Jardine, Bart. in a paper on the *Salmonidæ*, published in the Edinburgh New Philosophical Journal for January 1835, has described at considerable length the variations observed in the Trout of some of the lochs of Sutherlandshire. Other lochs abound with Trout which are reddish, dark, or silvery, according to the clearness of the water. Mr. Neill, in his Tour, has noticed the black-moss Trout of Loch Knitching, and Loch Katrine is said to abound also with small black Trout; an effect considered to be produced in some waters by receiving the drainings of boggy moors. In streams that flow rapidly over gravelly or rocky bottoms, the Trout are generally remarkable for the brilliancy and beauty of their spots and colours. Trout are finest in appearance and flavour from the end of May till towards the end of September; an effect produced by the greater quantity and variety of nutritious food obtained during that period. Two specimens of the Common Trout taken early in January were unusually fine in colour for that season of the year; their stomachs on examination were distended with ova of large size, which, from circumstances attending the capture of the Trout, were known to be the roe of the Bull Trout. The albuminous nature of this sort of food, which the Trout availed themselves of, was believed to be the cause of their colour; since other Trout, procured at the same time from localities where no such food could be obtained, were of the usual dark colour of that season of the year.

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* See page 108 of the present volume.

The author of Wild Sports in the West of Ireland refers particularly to the differences observed in the Trout of that country in this 35th letter:—"The fishing party had been successful, and returned late in the evening with two baskets of Trout, which, although of small size, were remarkable for beautiful shape and excellent flavour.

"It is a curious fact, that the loughs where the party angled, though situate in the same valley, and divided only by a strip of moorland not above fifty yards across, united by the same rivulet, and in depth and soil at bottom to all appearance, precisely similar, should produce fish as different from each other as it is possible for those of the same species to be. In the centre lake, the Trout are dull, ill-shapen, and dark-coloured ; the head large, the body lank, and though of double the size, compared to their neighbours, are killed with much less opposition. In the adjacent loughs, their hue is golden and pellucid, tinted with spots of a brilliant vermilion. The scales are bright, the head small, the shoulder thick, and, from their compact shape, they prove themselves, when hooked, both active and vigorous. At table they are red and firm, and their flavour is particularly fine ; while the dark Trout are white and flaccid, and have the same insipidity of flavour which distinguishes a spent from a healthy Salmon. The red Trout seldom exceed a herring-size ; and in looking through the contents of the baskets, which amounted to at least twelve dozen, I could only find two fish which weighed above a pound.

" The dark Trout, however, from their superior size, are more sought after by the mountain fishermen. They rarely are taken of a smaller weight than a pound, and sometimes have been killed, and particularly with a worm, or on a night-line, of a size little inferior to that of a moderate Salmon.

" I never observed the effect of bottom soil upon the quality of fish so strongly marked as in the Trout taken in a small lake in the county of Monaghan. The water is a long irregular sheet of no great depth ; one shore bounded by a bog, the other by a dry and gravelly surface. On the bog side, the Trout are of the dark and shapeless species peculiar to moory loughs ; while the other affords the beautiful and sprightly variety, generally inhabiting rapid and sandy streams. Narrow as the lake is, the fish appear to confine themselves to their respective limits ; the *red* Trout being never found upon the bog moiety of the lake, nor the *black* where the under surface is hard gravel."

Mr. Stoddart, in his "Art of Angling as practised in Scotland," mentions an interesting experiment made with Trout, some years ago, in the south of England, in order to ascertain the value of different food. "Fish were placed in three separate tanks, one of which was supplied daily with worms, another with live minnows, and the third with those small dark-coloured water-flies which are to be found moving about on the surface under banks and sheltered places. The Trout fed with worms grew slowly, and had a lean appearance; those nourished on minnows, which, it was observed, they darted at with great voracity, became much larger; while such as were fattened upon flies only, attained in a short time prodigious dimensions, weighing twice as much as both the others together, although the quantity of food swallowed by them was in nowise so great."

Of four Trout fed in a stew together, three of them weighed fifteen pounds each, the fourth attained the weight of seventeen pounds; but neither the food nor the time consumed was recorded.

A writer on fishes and fishing in the New Sporting Magazine for November 1840, says, page 275, "An acutely observing friend of mine, who has paid close attention to the growth of Trout, having regard to Mr. Shaw's experiments on Salmon, concludes that Trout are rarely visible the first year; that they congregate with Minnows, and other fry, the second; are found on shallows the third summer, about seven or eight inches long, and subsequently increase rapidly to a pound or a pound and a half, dependent on the quantity and quality of their food, the season, and other circumstances. This gentleman has, for years, kept Trout in a kind of store stream, and, having fed them with every kind of food, has had some of them increase from one pound to ten pounds in four years. I found, says he, that one of the Trout I had fed and weighed regularly for the last six years, was not improving in size and colour; I therefore killed it. The fish is a female, and weighed exactly seven pounds. The accompanying schedule will show its gradual increase:

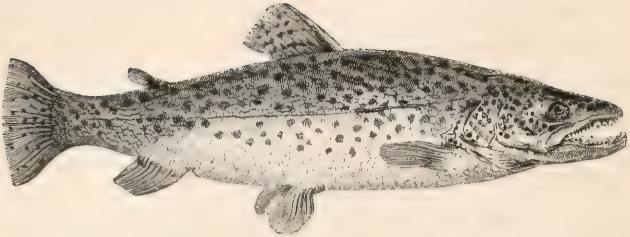
Date of weighing.	1835	1836	1837	1838	1839	1840
April 1st	0lb. 12oz.	1lb. 12oz.	3lb. 4oz.	5lb. 4oz.	7lb. 0oz.	7lb. 4oz.
October 1st	1 4	2 0	5 0	5 12	7 8	7 0

Littlecot, Oct. 1840.”

Stephen Oliver the younger, in his agreeable Scenes and Recollections of Fly-fishing, mentions a Trout “ taken in the neighbourhood of Great Driffield, in September 1832, which measured thirty-one inches in length, twenty-one in girth, and weighed seventeen pounds.” A few years since, a notice was sent to the Linnean Society of a Trout that was caught on the 11th of January 1822, in a little stream, ten feet wide, branching from the Avon, at the back of Castle-street, Salisbury. On being taken out of the water, its weight was found to be twenty-five pounds. Mrs. Powell, at the bottom of whose garden the fish was first discovered, placed it in a pond, where it was fed and lived four months, but had decreased in weight at the time of its death to twenty-one pounds and a quarter.

The age to which Trout may arrive has not been ascertained. Mr. Oliver mentions, that in August 1809, “ a Trout died which had been for twenty-eight years an inhabitant of the well at Dumbarton Castle. It had never increased in size from the time of its being put in, when it weighed about a pound ; and had become so tame, that it would receive its food from the hands of the soldiers.” In August 1826, the Westmoreland Advertiser contained a paragraph stating that a Trout had lived fifty-three years in a well in the orchard of Mr. William Mossop, of Board Hall, near Broughton-in-Furness.

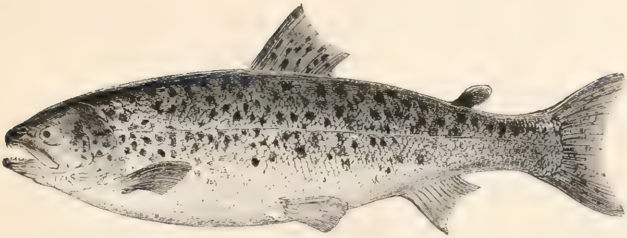
The Thames at various places produces Trout of very large size. Among the best localities may be named Kings-



ton, opposite the public-house called the Angler, Hampton-Court bridge and wear, and the wears at Shepperton and Chertsey. These large Trout are objects of great attraction to some of the best London anglers, who unite a degree of skill and patience rarely to be exceeded. The most usual mode practised to deceive these experienced fish is by trolling or spinning with a small Bleak, Gudgeon, or Minnow; and Trout of fifteen pounds' weight are occasionally taken.

On the 21st of March in the present year, 1835, a male Trout of fifteen pounds' weight was caught in a net. The length of this fish was thirty inches. On the 14th of April following, a male Trout of eleven pounds' weight, and measuring twenty-eight inches in length, was also caught in a net. From this second fish the representation above shown was taken, by permission of Mr. Groves, who allowed a drawing to be made, which was engraved for this work.

Several deep pools in the Thames above Oxford afford excellent Trout, and some of them of very large size. I have before me a record of six, taken by minnow spinning, which weighed together fifty-four pounds, the largest of them thirteen pounds. Few persons are aware of the difficulty of taking a Trout when it has attained twelve or fourteen pounds' weight, and it is very seldom that one of this size is hooked and landed except by a first-rate fisherman: such a



fish, when in good condition, is considered a present worthy a place at a royal table.

Among performances in Trout catching, the following may be mentioned, as found in the MS. of the late Colonel Montagu.

" Mr. Popham, of Littlecot, in the county of Wilts, was famous for a Trout fishery. They were confined to a certain portion of a river by grating, so that fish of a moderate size could not escape. To the preserving and fattening these fish much trouble and expense were devoted, and fish of seven and eight pounds' weight were not uncommon. A gentleman at Lackham, in the same county, had a favourite water-spaniel that was condemned to suffer death for killing all the Carp in his master's ponds, but was reprieved at the desire of Mr. Popham, who took charge of him, in the belief that so shy and so swift a fish as a Trout was not to be caught by a dog. However, in this he was mistaken, for the dog soon convinced him that his largest Trout were not a match for him." Mr. Stoddart also, in his Scottish Angling, page 119, has recorded the propensities of a fish-catching dog.

I am indebted to William Thompson, Esq. of Belfast, for a very fine specimen of the Gillaroo Trout of Lough Neagh, measuring twenty-two inches in length, from which fish the representation on this page was taken. The internal surface of the stomach presented an indurated cuticle, but the parietes were not thicker than those of other Trout; the cavity was filled with some dozens of the *Paludina impura* of Lamarck. The fin-rays and vertebræ were—

D. 12 : P. 14 : V. 9 : A. 11 : C. 19. Vertebræ 56.

So little difference appeared to exist between this and English specimens of *S. fario*, as to induce the belief that the Gillaroo is only a variety of the Common Trout, as stated by Pennant.

Several loughs in Ireland produce this fish, which sometimes attains the weight of ten or twelve pounds. The teeth are remarkably small, but in number and situation like those of *S. fario.*

The figure of the Trout at the head of this article, and the following description, were taken from a Hampshire fish of twelve inches in length.

The length of the head compared to the length of the head and body, not including the caudal rays, was as one to four; the depth of the body rather more than the length of the head; the dorsal fin commenced half-way between the point of the nose and the commencement of the upper caudal rays; the third ray of the dorsal fin, which is the longest, longer than the base of the fin: the origin of the adipose fin half-way between the commencement of the dorsal fin and the end of the upper half of the tail; the pectoral fin two-thirds of the length of the head; the ventral fins under the middle of the dorsal fin, and half-way between the origin of the pectoral fin and the end of the base of the anal fin; the anal fin begins half-way between the origin of the ventral fin and the commencement of the inferior caudal rays. The tail but slightly forked, and growing slowly up to square in old fish, or even very slightly convex, as seen in the figure of the large Thames Trout.

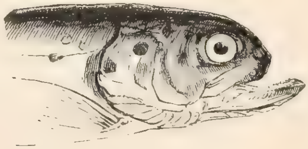
The fin-rays in number are—

D. 14 : P. 14 : V. 9 : A. 11 : C. 19. Vertebræ 56.

The form of the head blunt; the eye large, placed one diameter and a half from the end of the nose; the irides silvery, with a tinge of pink: the lower jaw in the *Salmonidæ* appears to be the longest when the mouth is opened, but it shuts within the upper jaw when the mouth is closed; the teeth numerous, strong, and curving inwards, extending along the whole length of the vomer; the disposition of the teeth and the form of the gill-cover shown in outline at page 3; but throughout the *Salmonidæ* the teeth of the males are larger than those of the females: the convexity of the dorsal and ventral outline nearly similar; the colour of the back and upper part of the sides made up of numerous dark reddish brown spots on a yellow brown ground; eleven or twelve bright red spots along the lateral line, with a few other red spots above and below the line; the lower part of the sides golden yellow; belly and under surface silvery white; the spots on the sides liable to great variation in number, size, and colour; dorsal fin and tail light brown, with numerous darker brown spots; the adipose fin brown, frequently with one or two darker brown spots, and edged with red; the pectoral, ventral, and anal fins uniform pale orange brown. The number of scales in a row above and underneath the lateral line about twenty-five

Deformed Trout are not uncommon. "In 1829," says the writer of the article on Angling in the seventh edition of the Encyclopædia Britannica, "we received some very singular Trouts from a small loch called Lochdow, near Pitmain, in Inverness-shire. Their heads were short and round, and their upper jaws were truncated, like that of a bull-dog. They do not occur in any of the neighbouring lochs, and have not been observed beyond the weight of half a pound."

Such a Trout from Lochdow was presented to the Museum of the Zoological Society by the Honourable Twiselton Fiennes: the figure is a representation of the head of that specimen.



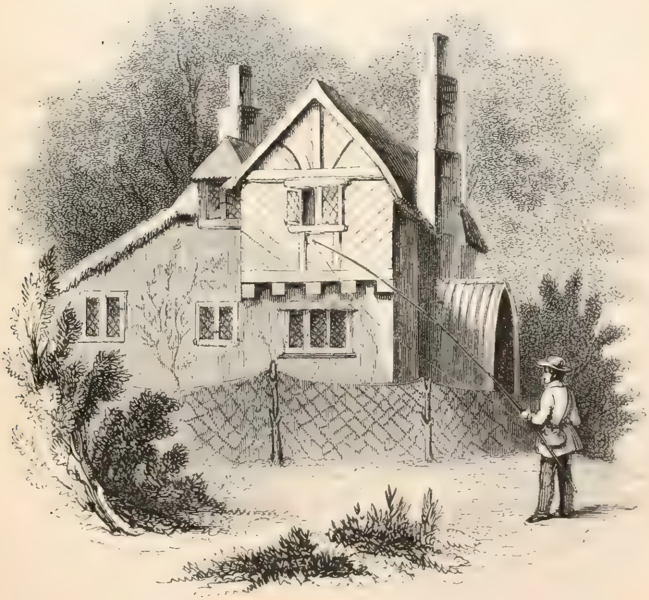
Mention of deformed Trout, as occurring in some of the lakes of Wales, is also made by Pennant, Oliver, and Hansard. I am indebted to the kindness of P. Buckley Williams, Esq. of Pennant House, Montgomeryshire, for a notice of the Hog-backed Trout of Plinlimmon, which is taken occasionally in Bagail Lyn, Shepherd's-pool, about one-third up the Plinlimmon mountains, on the Machynllaith, or western side. This Trout, of which a figure is given in the Cambrian Quarterly Magazine for July 1833, is not unlike in appearance that form which Perch sometimes assume, as mentioned in vol. i. page 5.

L. W. Dillwyn, Esq. sent me a copy of the following paragraph, which appeared in a Cambrian newspaper of the 28th of November, 1829. "As Abraham Harries and George Stephens, who reside at Llangattock, Carmarthenshire, were fishing with their nets in the river Towey on Friday last, they caught a fine fish of the Salmon species which had two heads and two tails. The heads are joined on one neck, and the tails meet about the centre. This fish is now to be seen alive in a small pool at Llangattock."

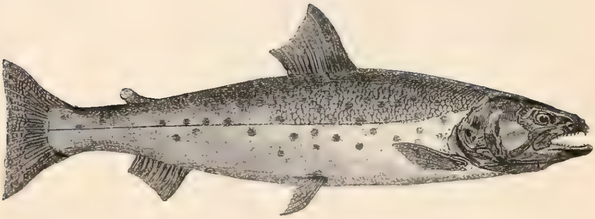
I have seen one very young specimen of our common Small Spotted Shark with two distinct heads: the whole fish was only about six inches long.

Malformations from deficiency in the number of bones of the mouth, or of other parts of the head, are not uncommon. One such instance in the Sea Bream is represented in vol. i. page 110, of the first edition of this work, and I have seen other instances among the flat fishes.

The vignette below represents a fishing cottage on the Inny, in Cornwall, the property of Georgiana, Duchess of Bedford.



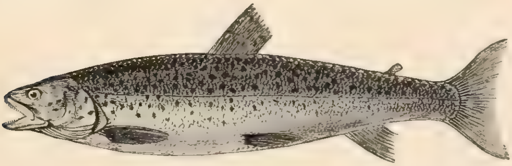
ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.*



THE GREAT LAKE TROUT. = S. trutta

Salmo ferox, JARDINE's Illust. Scot. Salm. pl. 4.
,, *lacustris*, *Lake Trout*, BERKENHOUT's Syn. Edit. 1795, vol. i. p. 79, sp. 3.
,, *ferox*, *Great Lake Trout*, JENYNS, Brit. Vert. p. 425.

THE GREAT LAKE TROUT of Loch Awe, to which attention has lately been drawn by the various notices that have appeared in print of the fish, as well as of the beauties of the locality, was shortly noticed by Pennant, in the editions of the British Zoology, as a native of Ullswater Lake in Cumberland, and of Lough Neagh in Ireland, and was considered to be identical with the Great Trout of the Lake of Geneva. Berkenhout includes this fish in his Synopsis of the Natural History of Great Britain and Ireland, as quoted above. Dr. Heysham records it in his Catalogue of Cumberland Animals as the Ullswater Trout and Grey Trout, some specimens of which were said to weigh between fifty and sixty pounds; and the Rev. Mr. Low, in his *Fauna Orcadensis*, mentions a Trout of thirty-six pounds' weight or more, which, besides the Common Trout, occurs both there and in Shetland. Mr. William Thompson of Belfast, when at the meeting of the British Association at Edinburgh in 1834, saw a specimen of the Great Trout of Loch Awe, and recognised it as identical with the Great Trout, or Buddagh, of Lough Neagh. Two examples of large size, about thirty-five inches each in length, were lately exhibited at the Zoological Society by Mr. Thompson.* These were obtained from Lough Neagh, where the younger and smaller sized fish of this species are called Dolachans. Mr. Thompson has since learned that this fish exists in Lough Corrib, in the county of Galway, and also in Lough Erne, in the county of Fermanagh, thus proving it, to use Mr. Thompson's words, to be an inhabitant of the three largest lakes in Ireland; and it will probably yet be found in most of the lakes of any considerable extent in that country. Mr. Thompson has very kindly supplied me with a young fish of this species from which the representation below was taken, and which, differing from specimens of large size in having the spots more numerous, may be an acceptable addition.



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* See the Report of the Proceedings of the Society for June 9th, 1835.

According to Sir William Jardine, this fish, as far as can be traced, seems to have been first noticed about forty-five years since by the late Mr. Morrison of Glasgow, who used to exhibit them to his friends as the trophies of his expeditions. The first specimens taken in Loch Awe by Mr. Selby and Sir William Jardine were considered as a species undescribed and new to Britain; and the name of *Salmo ferox* was given to it from its extreme voracity and rapacious habits. M. Agassiz, who saw specimens of this fish when he was in Edinburgh, pronounced it to be different from any of the large Continental species.

"In Scotland this fish appears to be generally distributed in all the larger and deeper lochs. Loch Awe, Loch Laggan, the upper end of Loch Shin, Lochs Loyal and Assynt, they certainly inhabit, roving indiscriminately, and feeding almost entirely upon the smaller fish. By persons residing on the banks they are taken by night-lines, few rising at the artificial fly; but they may always be taken by strong trolling tackle, baited with a small Trout. They are extremely voracious, and, having seized the bait, they will allow themselves to be dragged by the teeth for forty or fifty yards; and, when accidentally freed, will immediately again seize it."

This Great Trout is almost entirely confined to the lochs, seldom venturing far either up or down any of the streams communicating with them, and never descending to the sea. It is known to spawn in September.

The most usual mode of fishing for this Great Lake Trout is from a boat, which is rowed gently through the water; the bait, as before mentioned, a small Trout, guarded by six or eight large hooks; the rod and line of great strength; for this fish is considered to be even stronger than a Salmon of the same size, but not so active. Young fish from one to two pounds' weight rise freely to the usual Trout flies.

For the opportunity of obtaining a drawing of this fish I am indebted to the kindness of Mr. Selby and Dr. Richardson.

The length of the head is to the whole length of head, body, and tail, as one to four and a half; the depth of the body not equal to the length of the head: the teeth large, strong, and numerous, occupying five lines above and four below, thus extending along the length of the vomer: the free edge of the gill-cover rounded in the female, more angular below in the males; the inferior edge of the suboperculum, and the line of its junction with the operculum, oblique. The commencement of the dorsal fin is half-way between the point of the nose and the origin of the first upper caudal ray; the third dorsal fin-ray, which is the longest, equal to the length of the base of the dorsal fin; the soft fleshy fin half-way between the last dorsal fin-ray and the end of the caudal rays, and in a line over the origin of the last ray of the anal fin: the ventral fins each with an elongated axillary scale; the fins rather small in size, but very muscular. The fin-rays in number in this specimen from Loch Awe were —

D. 13 : P. 14 : V. 9 : A. 11 : C. 19.

The specimens examined from Lough Neagh had one ray less in the dorsal, pectoral, and anal fins, and one ray more in the caudal fin. For an excellent account of this fish, see the article Angling in the seventh edition of the Encyclopædia Britannica, from which I derive the following description of the colours of this species, which was probably taken from a recent specimen.

" When in perfect season and full-grown, it is a very handsome fish, though the head is always too large and long to be in accordance with our ideas of perfect symmetry in a Trout. The colours are deep purplish brown on the upper parts, changing into reddish grey, and thence into fine orange yellow on the breast and belly. The whole body, when the fish is newly caught, appears as if glazed over with a thin tint of rich lake colour, which fades away as the fish dies, and so rapidly, that the progressive changes of colour are easily perceived by an attentive eye. The gill-covers are marked with large dark spots; and the whole body is covered with markings of different sizes, and varying in number in different individuals. In some these markings are few, scattered, and of a large size; in others they are thickly set, and of smaller dimensions. Each spot is surrounded by a paler ring, which sometimes assumes a reddish hue; and the spots become more distant from each other as they descend beneath the lateral line. The lower parts of these fish are spotless. The dorsal fin is of the same colour with the upper part of the fish; it is marked with large dark spots; the pectoral, ventral, and anal fins are of a rich yellowish green colour, darker towards their extremities. The tail is remarkable for its breadth and consequent power. In adults it is perfectly square, or might even be described as slightly rounded at its extremity: in the young it is slightly forked, and appears to fill up gradually as the fish advances in age."

"The flavour of this great lacustrine species is coarse and indifferent. The colour of the flesh is orange yellow, not the rich salmon-colour of a fine Common Trout in good season." Pennant states from experience that it is but an indifferent fish. The stomach is very capacious, and is almost always found gorged with fish. I have not had an opportunity of ascertaining the number of vertebræ.

The form of the scales is decidedly different from that of the Trout, and more circular than those of any of the migrating species: they are thin, flexible, and covered with a delicate membrane.

I have reason to believe that this same species of Great

Lake Trout is an inhabitant of some of the large lakes of Scandinavia.

Sir Thomas Maryon Wilson, Bart. visited Sweden last summer, ascending the Gota river in his yacht, the Siren, and passing through the celebrated sluices of Tröllhattan, cruised and fished in Lake Wenern, visiting his friend Mr. Lloyd, who resides near the southern extremity of this noble lake.

Sir Thomas M. Wilson brought back with him five or six skins of the Great Trout of the Lake, which were caught by spinning with a bleak, and must, from their large size, have afforded some excellent diversion. The largest of these specimens measured forty-two inches in length, and weighed about thirty-four pounds: the next largest weighed thirty-two pounds: the third twenty-seven pounds, besides others of smaller size. These large Trout, and larger than these are seldom seen, are observed to be males; the females, according to Mr. Lloyd, who has lived for some years on the borders of the lake, rarely exceed twenty or twenty-two pounds.

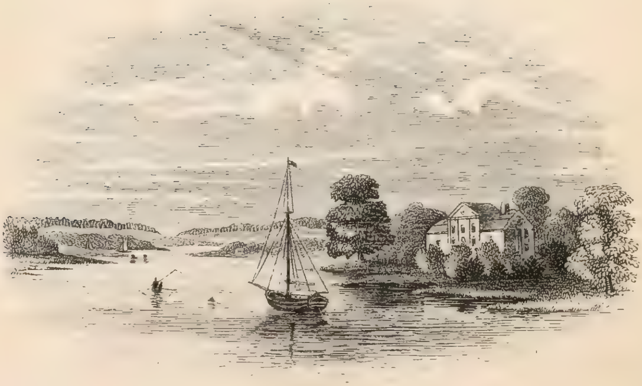
The number of fin-rays in these specimens averaged—

D. 13 : P. 14 : V. 9 : A. 11 : C. 19.

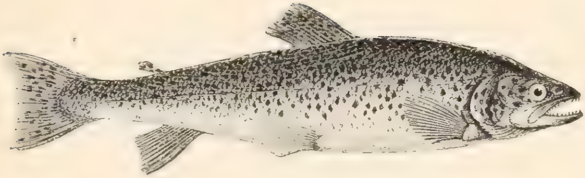
Among other fish taken by Sir Thomas Wilson, was a large specimen of the Ide, *Leuciscus idus* of authors. This fish, which resembles our English Chub, was caught in the Gotha Elf, a short distance above the falls of Tröllhattan, whilst trolling for Pike on a windy day: its weight was between four and five pounds. The skins of these various specimens were effectually preserved and mounted after they were brought to England.

Sir Thomas M. Wilson did me the favour to show me his numerous sketches of scenery, taken during this trip, which include views of the Gota river, the cities and country on its banks, the celebrated falls of Tröllhattan and parts of Lake

Wenern at different points of view; very kindly allowing me the use of a coloured drawing, from which the vignette below, on a reduced scale, was taken. This view represents Mr. Lloyd's cottage on the eastern bank of the Gota; the yacht of Sir Thomas Wilson lying at anchor immediately opposite; with the remarkable and finely wooded hills of Hunneberg and Halleberg, so much celebrated for the peculiarity of their geological structure, bounding the distance.



ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.*



THE LOCHLEVEN TROUT. = [illegible]

Salmo Levenensis, Walker.
,, *cæcifer*, Parnell.

I am indebted to Dr. Parnell for the loan of a beautiful specimen of this Trout from which the figure was taken, and the following account of it by Dr. Parnell is from the seventh volume of the Memoirs of the Wernerian Natural History Society of Edinburgh.

"This fish is considered by most writers on British Ichthyology to be identical with *Salmo fario*, the Common Trout, differing from it only in the colour of the flesh, and in having no red spots on the sides. It is true that food and season may have a great share in diminishing or increasing the external markings and colour of the flesh;* but they can have no effect in shortening or lengthening the rays of the fins, or in adding numbers to the cæcal appendages."

"The differences that exist between *S. cæcifer* and *S.*

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* James Stuart Menteath, Esq. of Closeburn, caught a number of small river Trout, and transferred them to a lake (Loch Ettrick) where they grew rapidly; their flesh, which previously exhibited a white chalky appearance, became in a short time of a deep red, while their external appearance remained the same from the time they were first put in.

fario are very striking. The pectorals in *S. cæcifer* when expanded are pointed, in *S. fario* they are rounded. The caudal fin in *S. cæcifer* is lunated at the end; in *S. fario* it is sinuous or even. *S. cæcifer* has never any red spots; *S. fario* is scarcely ever without them. The caudal rays are much longer in *cæcifer* than in *fario*, in fish of equal length. In *S. cæcifer* the tail fin is pointed at the upper and lower extremities; in *S. fario* they are rounded. The flesh of *S. cæcifer* is of a deep red, that of *S. fario* is pinkish and often white. The cæcal appendages in *S. cæcifer* are from sixty to eighty in number; in *S. fario* I have never found them to exceed forty-six."

"Lochleven (of which the barren isle and now dismantled castle are famous in history as the prison-place of the beautiful Queen Mary) has long been celebrated for its breed of Trout. These, however, have fallen off of late considerably in their general flavour and condition, owing, it is said, to the partial drainage of the Loch having destroyed their best feeding ground, by exposing the beds of fresh-water shells, the animals of which form the greater portion of their food.* They spawn in January, February, and March."

"The fish described does not appear to be peculiar to this Loch, as I have seen specimens that were taken in some of the lakes in the county of Sutherland with several other Trout, which were too hastily considered as mere varieties of *S. fario*. It is more than probable that the Scottish lakes produce several species of Trout known at present by the name of *S. fario*, and which remain to be further investigated."

Dr. Richardson, who has had opportunities of examining very fine specimens of this celebrated Trout, considers it distinct from *S. fario*, and has pointed out some of the differences between them: the scales are thick, and when dry exhibit a small ridge in the centre of each, not perceived in other Trout: in its large and strong fins, and in its habit, as stated by Dr. Parnell, of spawning in spring, it differs from *S. fario*, which spawns in autumn, and resembles some of the large species of Trout of the great northern lakes. Three individuals of the Lochleven Trout dissected by Dr. Richardson had each seventy-three pyloric cæca, and in one of them fifty-nine vertebræ were counted. The largest of the specimens measured twenty inches and a quarter, including the caudal fin, and two inches less to the end of the scales.

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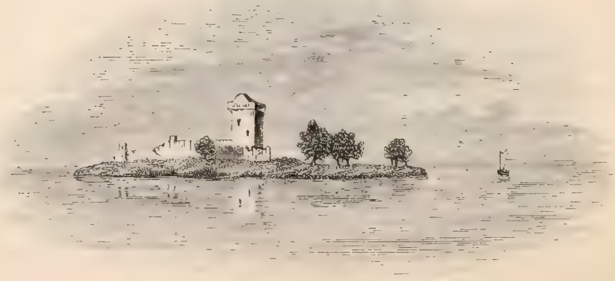
* There are two or three varieties of *S. fario* in Lochleven with white and pinkish flesh, which are much inferior in flavour to *S. cæcifer*.—Encyc. Brit.

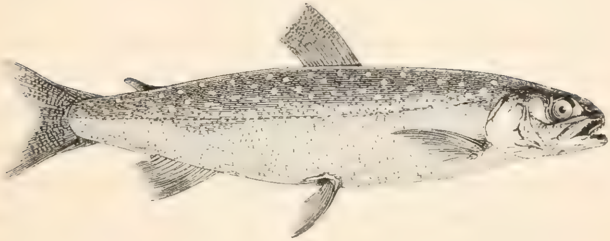
Dr. Parnell's description, taken from a specimen measuring one foot in length, is as follows: "Head rather more than one-fifth of the whole length, caudal fin included; depth between the dorsal and ventral fins less than the length of the head. Gill-cover produced behind; basal margin of the operculum oblique; preoperculum rounded; end of the maxillary extending back as far as the posterior margin of the orbit. Colour of the back deep olive green; sides lighter; belly inclining to yellow; pectorals orange, tipped with grey; dorsal and caudal fins dusky; ventral and anal fins lighter; gill-cover with nine round dark spots; body above the lateral line with seventy spots; below it ten; dorsal fin thickly marked with spots of a similar kind; anterior extremities of the anal and dorsal fins without the oblique dark bands which are so conspicuous and constant in many individuals of *S. fario*. First dorsal fin placed half-way between the point of the upper jaw and a little beyond the fleshy portion of the caudal extremity of the body; all the rays branched except the two first; the third ray the longest, equalling the length of the long caudal ray; the seventh as long as the base of the fin; the last considerably more than half the length of the third, equalling the length of the middle caudal ray; fin even at the end (in many specimens it is concave, with the last ray longer than the preceding one); caudal fin crescent-shaped, the middle ray rather more than half the length of the longest ray; third ray of the anal fin the longest, equalling the length of the fifth dorsal ray; the last ray as long as the base of the fin, ventral fin equalling the length of the fifth ray of the anal; the third ray the longest; third ray of the pectorals equalling the length of the long caudal ray; the last ray half the length of the fin. Teeth stout and sharp, curved slightly inwards; thirty-two in the upper jaw, eighteen on the lower; twelve on each palatine bone; thirteen on the vomer; and eight on the tongue. Scales small and adherent; twenty-four in an oblique row between the middle dorsal ray and the lateral line; flesh deep red; cæca eighty. The number of fin-rays—

D. 12 : P. 12 : V. 9 : A. 10 : C. 19.

The vignette represents the castle and the island in Lochleven.



ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.*



THE CHARR.

– [illegible]

Salmo	*salvelinus,*	LINNÆUS.	BLOCH, pt. iii. pl. 99.
,,	*umbla,*	,,	,, ,, pl. 101.
,,	*alpinus,*	,,	,, ,, pl. 104.
,,	*umbla,*		CUVIER, Règne An. t. ii. p. 305.
,,	*alpinus,*	*Charr,*	PENN. Brit. Zool. vol. iii. p. 411, pl. 71.
,,	*salvelinus,*	*Salvelian Charr,*	DON. Brit. Fish. pl. 112.
,,	*alpinus,*	*Alpine Salmon,*	,, ,, pl. 61.
,,	*salvelinus,*	*Torgoch,*	FLEM. Brit. An. p. 180, sp. 43.
,,	*alpinus,*	*Case Charr,*	,, ,, ,, sp. 44.
,,	*umbla,*	*Charr,*	JENYNS, Brit. Vert. p. 427.

M. AGASSIZ, when in the North of England in the autumn of 1834, had several opportunities of examining the Charr of the Northern lakes, which he declared to be identical with the *Ombre Chevalier* of the Lake of Geneva; and in his "Remarks on the different species of the genus *Salmo* which frequent the various rivers and lakes of Europe," read at the meeting of the British Association at Edinburgh, that gentleman considered the *S. umbla*, *alpinus*, *salvelinus*, and *salmarinus* of Linnæus as different states only of the same fish.*

Examples of the Charr of the Northern lakes of England agree exactly with the description and figure of the *Ombre Chevalier* in M. Jurine's paper on the fishes of Lake Leman, Geneva.

In the former edition of this work I considered the Welsh Charr distinct as a species from the Northern Charr, but I have now reason to believe that I had not made sufficient allowance for the variations in appearance produced by local influence, as mentioned under the head of Common Trout, at page 97; and, assisted by the published notes of W. Thompson, Esq. of Belfast (An. Nat. Hist. vol. vi. p. 439), I am now induced to consider as one species the Charr of England, Scotland, Ireland, and Wales, and that our fish is also the same species as that found in Germany, in the lakes of Switzerland, and also those of Scandinavia.

Mr. Thompson precedes his notes by the following remarks:—"The chief object of my inquiry was to learn whether in the lakes of Ireland, and in those of Scotland, from which I could procure specimens, the *S. salvelinus* of Donovan was to be found; and at the same time to ascertain, at least for my own satisfaction, whether its characters have sufficient permanency to entitle it to rank as a distinct species. As they are merely crude unfinished notes that are to follow, I shall here give the result of the investigation, that the reader may be in possession of it without entering into the details. In a fresh state I have had the opportunity of examining Charr from three localities,—Windermere (England), Lough Melvin (Ireland), and Loch Grannoch (Scotland); and, either in spirits or preserved dry, from nine other lakes in Ireland and Scotland. The examination of these examples leads me to believe that the *S. umbla* of Linnæus, and the *S. salvelinus* of Donovan, are but one species; one, however, that, like the *Salmo fario*, is subject to extraordinary variety. In one lake the male fish can at a glance be distinguished from the female either by colour, or by the many characters which are comprised under 'form.' In another, so similar are the sexes in every external character, that, without the aid of dissection, they cannot be determined. In size we find the species ordinarily attain twice the length, and several times the weight, in one lake that it does in another, although the area of their waters is of similar extent; indeed, in some of the largest lakes, this fish will be found not to attain near the size it does in some others which are but as pools in comparison: there are, however, various influences which account satisfactorily for such differences. In the form of the body again we find the species, and when in equally high condition, to be in one lake herring-like, and in another approximating the roundness of an eel. So manifold are the differences presented by the Charr now before me from various localities, that it would be tedious, and perhaps useless, to point them out."

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* See the Reports of the Fourth Meeting of the British Association, p. 617 to p. 623.

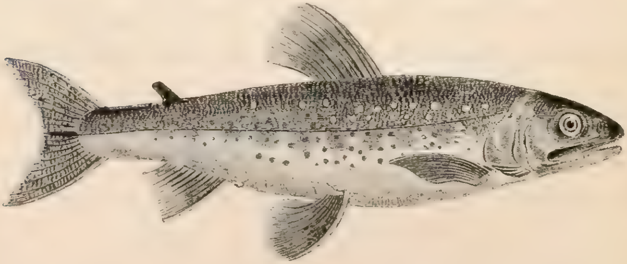
The Charr inhabits many of the lakes of Cumberland, Westmoreland, and Lancashire, which are annually visited by the admirers of fine scenery. Keswick, Crummock Water, Buttermere, Winandermere, and Coniston are among the localities best known to produce this delicate fish. It occurs in several of the lochs of Scotland, and also in Lough Melvin, Corrib, Esk, Egish, Neagh, Dan, Luggelaw, and probably many other loughs in various counties of Ireland.

The Charr is the Torgoch or Red-belly of Wales, and was formerly to be taken either in Llanberris Lake, or in Llyn Cawellyn, two deep lakes situated on the east and west sides of Snowden. The waters from a neighbouring copper-mine are said to have destroyed or driven out the Charr from

Llanberris, where they were formerly very numerous; and it was remarked that some of these fish were caught in the sea, at the mouths of rivers on this coast, after they disappeared from the lake.

" Llyn Cawellyn," says Mr. Donovan, " is a vast lake of unknown depth, sheltered on one side by an abrupt mountain, which rises immediately out of the water, and in the deep recesses at the base of which the Torgoch is supposed to pass the milder seasons of the year in perfect security. These fish approach the shallower parts of the lake in winter, about the middle of December, appearing in small troops at a short distance from the shores, and are at this season taken in some plenty by a poor cottager who resides in the vicinity of the lake, and derives a small annual profit from the fishery; this delicious fish being in much request for the tables of the neighbouring gentry."

I am indebted to the kindness of the Rev. F. W. Hope for specimens of Charr from a locality near Barmouth in Merionethshire, unnoticed by Mr. Donovan, but recorded by Willughby. The piece of water is called Coss-y-gedawl—the lake of the fruitful marsh. The meaning of this term is said to be questionable: the primitive from which it is derived means gift, relief, or profit. By Willughby it is spelt Casageddor; by others, Cors-y-gedol.



The Charr generally inhabit the deepest parts of those lakes in which they are found, and afford but little amusement to the angler. The most successful mode of fishing for them is to trail a very long line after a boat, using a minnow for a bait, with a large bullet of lead two or three feet above the bait, to sink it deep in the water. By this mode a few may be caught in the beginning of summer, at which time they are in the height of perfection, both as to colour and flavour. The fly-fisher when whipping for Trout, which frequently abound in the same lakes, occasionally takes a Charr; but this does not happen often: they are believed to feed principally during the night. The stomachs of those I have examined were empty; but Sir William Jardine has found abundance of minute *Entomostraca* in the stomachs of some of those examined by him. The forms of two species of these very minute animals will be represented when describing the Vendace.

The Charr are very seldom known to wander into any of the streams by which these lakes are either supplied or drained, except at the season of spawning, and their decided partiality for clear water and a hard bottom is then very conspicuous. Winandermere has two principal feeders, the rivers Rothay and Brathay: the Rothay has a sandy bottom, but the channel of the Brathay is rocky. These streams unite at the western corner of the head of the lake, below Clappers-gate, at a place called the Three-foot-brander, and after a short course boldly enter the lake together. The spawning season is in November and December; about which time the Charr in shoals make their way up both these rivers, but invariably, before depositing their spawn, those fish which have ascended over the sandy bed of the Rothay return and pass up the rocky channel of the Brathay.* A few Charr also spawn in the lake; and it is observed that they frequent the stony parts only which resemble the bottom of the Brathay.

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* The Trout, in their spawning season, prefer the Rothay.

Charr, even at the same season of the year, exhibit considerable difference in colour, which has been attributed to different causes. M. Jurine, when describing the *Salmo umbla* of the lake of Geneva, which fish there is little or no doubt is identical with our Charr, says the females are the finest in colour. Mr. Mascall, in a communication to the Magazine of Natural History for April 1835, states that he found the males of the Charr of Ennerdale Lake in Cumberland superior to the females in colour. It is not improbable that the degree of colour may depend, not so much upon the sex, as upon the constitutional vigour of the individual fish ; a circumstance observed in the periodical assumption of peculiar tints in other animals. In reference to these variations in the intensity of the colours, several distinctions have been supposed to exist in the Charr of our lakes, and the names of Case Charr, Gilt Charr, Red Charr, and Silver Charr have been applied to them : Pennant, however, states that, after the closest examination, he was unable to discover any specific difference.

The most common size of our Charr is from nine to twelve inches in length ; they are said occasionally to attain the length of two feet ; the largest specimen in my possession measures eighteen inches. The finest coloured specimen I ever saw was brought me by my friends J. B. Giles and W. C. Hewitson, from Coniston Water, in the month of May. They are considered to be in the greatest perfection as food from July to October.

The length of the head compared to the length of the head and body is as one to five ; the depth of the body greater than the length of the head : the commencement of the dorsal fin is half-way between the point of the nose and the adipose fin ; the posterior edge of the base of the adipose fin half-way between the origin of the last dorsal fin-ray and the end of the longest caudal ray; the longest dorsal fin-ray but one-fourth longer than the base of that fin: the pectoral fin small; the ventral fins originate half-way between the point of the nose and the commencement of the under caudal rays; the ventral axillary scale nearly half as long as the fin; the anal fin small, the longest ray but little longer than the base of the fin; the tail deeply forked, the longest rays more than as long again as those in the centre; all the fins of small comparative size. The fin-rays in number are—

D. 13 : P. 12 : V. 9 : A. 11 : C. 19. Vertebræ 59.

The diameter of the eye is less than one-fourth of the length of the whole head; it is placed at the distance of one diameter from the point of the nose: the teeth small; a few on the anterior part only of the vomer; the other four rows above and four rows below, as usual in the fishes of this genus. The branchiostegous rays vary from ten to twelve, and frequently differ in number on the two sides of the head of the same fish.

The top of the head and all the upper parts of the back umber brown; the sides lighter; the whole of the belly, pectoral, ventral, and anal fins, deep reddish orange; the first ray of the ventral and anal fins white; the sides above and below the lateral line marked with numerous red spots; the irides orange; gill-covers yellowish olive; dorsal and caudal fins dark brown, tinged with purple brown; the lateral line straight, but rising gradually from the parallel of the point of the pectoral fin to the top of the operculum; the scales very small, more than thirty in an oblique line from the base of the dorsal fin to the lateral line, and as many from the ventral axillary scale upwards to the lateral line. In this state as to colour, this fish is considered to be the *S. salvelinus* of authors.

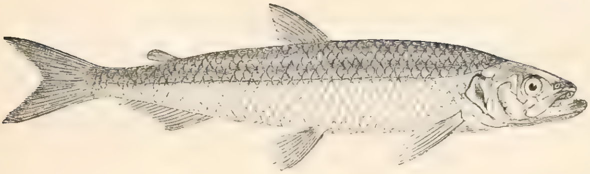
When not in fine condition as to colour, the top of the head and along the back are pale purplish brown, becoming lighter lower down; the sides silvery; the belly tinged with pale orange; above the lateral line are numerous small round white spots; irides and gill-covers silvery, with a tinge of yellow; pectoral, ventral, and anal fins, brownish red; dorsal fin brown; caudal fin purple brown.

In this state, as to colour, this fish is considered to be the *S. alpinus* of Continental authors, Bloch excepted, whose *S. alpinus*, part iii. plate 104, appears to be a Trout.

In the autumn of 1839, T. Upton, Esq. of Ingmire Hall, near Sedberg, put into his lake, the Lilleymere, near the reservoir, some Charr from Windermere, each weighing about half a pound; and, on the 23rd of August 1840, caught two with a fly, full two pounds' weight each, in the finest possible season, well fed, and beautifully coloured. These fine specimens were served at the Queen Dowager's table, at the Rose and Crown, Kirkby Lonsdale.

The vignette is a view of Whitewell, in the forest of Bowland, Yorkshire.

ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.*



THE SMELT.

SPIRLING AND SPARLING. *Scotland.*

Osmerus eperlanus,	*Smelt,*	Flem. Brit. An. p. 181, sp. 48.
,, ,,		Cuvier, Règne An. t. ii. p. 305.
Eperlanus Rondeletii,		Willughby, p. 202.
,, *Schonfeldii,*	,,	Willughby, tab. N. 6, fig. 4.
Salmo eperlanus,		Linnæus. Bloch, pt. i. pl. 28. 2.
,, ,,	,,	Penn. Brit. Zool. vol. iii. p. 416, pl. 72.
,, ,,	,,	Don. Brit. Fish. pl. 48.
Osmerus ,,	,,	Jenyns, Brit. Vert. p. 429.

Osmerus. *Generic Characters.*—Body elongated, covered with small scales: two dorsal fins, the first with rays, the second fleshy, without rays; ventral fins in a vertical line under the commencement of the first dorsal fin: teeth on the jaws and tongue very long, two distinct rows on each palatine bone, none on the vomer except at the most anterior part; branchiostegous rays 8.

The Smelt, as a British fish, appears to be almost exclusively confined to the eastern and western coasts of Great Britain. I am not aware of any good authority for the appearance of the true Smelt between Dover and the Land's End.* The fish called Smelt and Sandsmelt along the extended line of our southern coast is in reality the Atherine, as stated in the account of that fish, volume i. page 229: but the Atherine, though furnished with two dorsal fins, and otherwise something like the Smelt, is immediately distinguished from it by the numerous rays supporting the second dorsal fin; which fin in the true Smelt is without any rays whatever, like the adipose fin of the species of the genus *Salmo* last described.

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* Mr. Salter, in his Angler's Guide, page 169, says he has caught very fine Smelts by angling in Portsmouth harbour; but there is very little doubt that the Sandsmelt, or Atherine, which is there abundant, is the fish alluded to.

On the eastern side of our island, the Smelt occurs in the Tay, in the Frith of Forth, in the Ure on the Yorkshire coast; it is taken in abundance in the Humber, on the Lincolnshire coast, in the Yare of Norfolk of large size, in the Thames, and the Medway. On the western side, the Smelt is taken in the Solway Frith, and may be traced as far south as the parallel line formed by the Mersey, the Dee, the Conway, and Dublin Bay.

The Smelt inhabits fresh water from August to May. After spawning in March or the beginning of April, they return to the sea. The ova are small and yellowish in colour. The fry are found about three inches long, swimming near the surface in shoals in the rivers in the month of August, ascending and descending with the tide, when the adult fish are again visiting the fresh water. Their food is small fish, with crustaceous and testaceous animals: Dr. Fleming says, the principal food of the Smelt in the Tay is the shrimp.

Two modes of fishing for Smelts are in practice; one on the sandy shallow shores of the sea, on the eastern coast, particularly Lincolnshire, where large quantities are taken in spring; the other is the river-fishing within the tide-way. The excellence of the Smelts of the Medway is well known. The Thames and Medway fishing with small-meshed nets for Smelts is permitted, under the jurisdiction of the Lord Mayor of London, from the 28th of August (St. Augustine) till Good Friday. Formerly, the Thames from Wandsworth to Putney-bridge, and from thence upwards to the situation of the present suspension-bridge at Hammersmith, produced abundance of Smelts, and from thirty to forty boats might then be seen working together; but very few are now to be taken, the state of the water, it is believed, preventing the fish advancing so high up. The particular cucumber-like smell of this fish is well known; and it is very considerably more powerful when they are first taken out of the water.

The Smelt is generally in great request from its delicate and peculiar flavour. This quality, coupled with the circumstance of the fish passing six or seven months of the year in fresh water, has induced two or three experiments to retain it in ponds, one of which was attended with complete success, and the attempts might be multiplied with advantage. Colonel Meynell, of Yarm in Yorkshire, kept Smelts for four years in a fresh-water pond having no communication with the sea: they continued to thrive, and propagated abundantly. They were not affected by freezing; as the whole pond, which covered about three acres, was so frozen over as to admit of skating. When the pond was drawn, the fishermen of the Tees considered that they had never seen a finer lot of Smelts. There was no loss of flavour or quality.

From the point of the lower jaw to the end of the gill-cover, the length is, as compared to the body alone, as one to three; the depth of the body not equal to the length of the head: the dorsal fin commences half-way between the point of the nose and the end of the fleshy portion of the tail; the first ray of this fin less than half the length of the second, which is as long as the third; the second and third are the longest rays in the fin, nearly as high as the body of the fish is deep, and as long again as the base of the fin; the two first rays simple, all the others branched: the anterior edge of the adipose fin is half-way between the base of the last ray of the dorsal fin and the end of the fleshy portion of the tail, and in a vertical line over the middle of the anal fin; pectoral fins long and narrow; the ventral fins commence on the same plane as the dorsal fin; the base of the anal fin long, commencing half-way between the origin of the ventral fins and the end of the fleshy portion of the tail; the third ray the longest, but not so long as the base of the fin; the other rays diminish in length gradually: the tail slender and deeply forked. The fin-rays are—

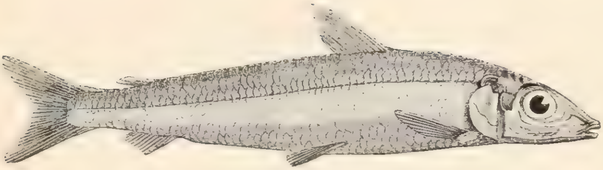
D. 11 : P. 11 : V. 8 : A. 15 : C. 19.

The lower jaw much longer than the upper; the gape deeper than wide: the teeth long, and curving inwards; those on the anterior parts of the tongue and palatine bones are the longest: the breadth of the eye about one-fifth of the whole length of the head, the irides silvery white; the gill-cover triangular; the upper part of the head flat; the nape and back rising; the form of the body elongated and slender; the dorsal and abdominal lines slightly convex: the colour of the upper part of the body pale ash-green; all the lower parts, cheeks, and gill-covers, brilliant silvery white: the scales oval, small, and deciduous: all the fins pale yellowish white: the ends of the caudal rays tipped with black.

The specimen described measured seven inches in length. Occasionally Smelts may be seen in the London markets ten and eleven inches long, but this is an unusually large size. Pennant mentions having seen one that was thirteen inches long, and weighed eight ounces.

ABDOMINAL
MALACOPTERYGII.

SALMONIDÆ.



THE HEBRIDAL SMELT.

Osmerus Hebridicus, Hebridal Smelt, YARRELL, Supplement to Brit. Fishes.

I AM indebted to Mr. William Euing of Glasgow for the opportunity of making known a new species of Smelt which that gentleman did me the kindness to send to me in the month of November 1837. This fish is at once clearly distinguishable from our long-known and highly-esteemed favourite, the common Smelt, and is the more interesting from the circumstance of its being—at least, as far as I am aware—entirely new to Ichthyology. Mr. Euing passed part of the summer of 1837 near Rothsay in the Isle of Bute; and the Smelt in question was brought to him by a fisherman, who stated that he caught it on a hand-line in the bay of Rothsay, about two hundred yards from the shore, in twelve fathom water; that it was, though well known, but rarely seen. This specimen measured six inches and a half; but another example of the same sort, measuring eight inches in length, that was taken near the same place in June 1836, was full of roe, and when first caught the cucumber-like smell, so peculiar to the Smelt, was in this species also very apparent.

Unable to find any notice of a second species of Smelt in Europe in any Ichthyological work with which I am acquainted, I have little doubt that this fish has not been previously described; and in reference to the locality in which alone it has been as yet taken, I have ventured to name it the Smelt of the Hebrides, *Osmerus Hebridicus.*

The specimen sent me by Mr. Euing, measuring six inches and a half in length, is one inch and one-eighth deep at the commencement of the dorsal fin, at which part the body is deepest; the thickness of the body compared to the depth is as one to two, or exactly half: the length of the head is one inch and three-eighths, and is, in reference to the whole length of the head and body, without the tail, as one to four. The jaws are nearly equal in length, without teeth upon either; but there are four long teeth upon the tongue; the eye is very large, the diameter almost equal to one-third of the whole length of the head, and placed at a distance of little more than its own diameter from the point of the nose: the upper surface of the head is flattened, descending by a rapid slope to the nose; the line of the lower jaw straight; the posterior edge of the operculum rounded; the back of the fish, or its dorsal outline, slightly arched; the abdominal line nearly straight; the sides compressed. The dorsal fin commences half-way between the point of the nose and the anterior edge of the adipose or rayless dorsal fin, the longest ray nearly twice the length of the base of the fin; the last dorsal fin-ray but three, the same length as the base of the whole fin. The adipose fin is placed very near the tail; the tail itself deeply forked. The pectoral fin reaches to the plane of the commencement of the dorsal, and its length, if turned forwards, would reach to the centre of the eye. The ventral fin is in a vertical line under the last ray of the dorsal fin; there is a slender axillary scale; but the ends of the ventral fin-rays being injured, the length of the fin cannot be mentioned.

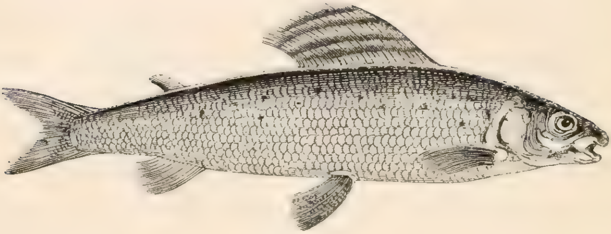
The anal fin has its last ray underneath the posterior edge of the adipose fin; but the rays of the anal fin are also broken. The formula of the fin-rays is as follows:—

D. 11 : P. 14 : V. 12 : A. 12 : C. 19.

The scales are large and deciduous, the lateral line prominent and nearly straight. Below the lateral line for the whole length of the body two rows of the scales are silvery white, forming a conspicuous elongated band, like that to be observed in the Atherine; the rest of the body and fins dull amber colour, the gill-covers silvery and iridescent.

ABDOMINAL
MALACOPTERYGII.

SALMONIDÆ.



THE GRAYLING.

Thymallus vulgaris,	Cuvier, Règne An. t. ii. p. 306.	
,, ,,	Willughby, p. 187, N. 8.	
Salmo thymallus,	Linnæus. Bloch, pt. i. pl. 24.	
,, ,,	*Grayling,*	Penn. Brit. Zool. vol. iii. p. 414, pl. 72.
,, ,,	,,	Don. Brit. Fish. pl. 88.
Coregonus ,,	,,	Flem. Brit. An. p. 181, sp. 49.
Thymallus vulgaris,	,,	Jenyns, Brit. Vert. p. 430.

Thymallus. *Generic Characters.*—Head and body elongated; the sides marked with longitudinal bands; two dorsal fins, the first much longer than high, with numerous rays; the second small, adipose, without rays: the mouth small, the orifice square; the teeth very small; branchiostegous rays 7 or 8.

The Grayling, though abundant in some streams, is yet a very local fish. Similar in many respects to the Trout in its habits and wants, there are numbers of rivers abounding with Trout that do not produce Grayling. In the southern counties of Hampshire and Wiltshire, the Grayling is found in the Test and both the Avons. In Herefordshire, in the Dove, the Lug, the Wye, and the Irvon. In Shropshire, in the Teme and the Clun. In

Staffordshire, in the Hodder, the Trent, the Dove, and the Wye. In Derbyshire, in the Dove. In Merionethshire, in the Dee, between Curwen and Bala. In Lancashire, in the Ribble. In Yorkshire, in the Derwent, the Ure, the Wharfe, and the Wiske, near Northallerton. Dr. Heysham says it is occasionally taken in the Eden and the Esk in Cumberland. It is not found, that I am aware, either in Ireland or Scotland ; Mr. Low, however, includes this fish in his *Fauna Orcadensis*, and it is known to be plentiful in Sweden, Norway, and Lapland. The peculiarity of the local distribution in this country gave rise to the supposition that the Grayling had been originally introduced by the monks, as a fish worth cultivating ; many of the rivers containing the Grayling being near the remains of great monasteries. But two circumstances affect this solution : it would be very difficult to bring this fish alive from the Continent to this country ; and it is not found in the rivers of Kent, Dorsetshire, Devonshire, or Cornwall, where monastic establishments were formerly numerous.

The Grayling thrives best in rivers with rocky or gravelly bottoms, and seems to require an alternation of stream and pool. According to Sir Humphrey Davy, who has given a good history of the Grayling in his "Salmonia," this fish was introduced into the Test, in Hampshire, from the Avon ; and the former river, in particular parts, appears to suit it the better of the two. Large Grayling, are, however, occasionally taken in both these waters, which are constantly resorted to by the southern anglers. Three Graylings, weighing together twelve pounds, were caught by Thomas Lister Parker, Esq. in the Avon, near Ringwood. A Grayling of four and a half pounds' weight has been killed in the Test, and one of five pounds is recorded to have been caught near Shrewsbury.

However fastidious in the quality of the water or the choice of situation in the stream the Grayling is known to be, experiment has proved that this fish will live in ponds that have been newly made in hard soil, or in such as have been very recently and carefully cleaned out; but in these situations the Grayling does not breed, and they will not continue to live in old muddy ponds. The ova of this fish are numerous, large, and of a deep orange colour; the spawning season is in April, or the beginning of May; in this respect differing from the other *Salmonidæ*, most, if not all, of which spawn towards the end of the year, and generally in cold weather. The Grayling, however, is in the finest condition in October and November, when Trout are out of season, not having then recovered the effects of their recent spawning.

The food of the Grayling, as ascertained by examination, besides the various flies—imitations of which are successfully used by anglers,—consists also of the larvæ of *Phryganea*, *Ephemera*, and *Libellula;* the remains of the cases of the former, and the tough skins of all of them, being frequently found in their stomachs. I have found also several small shells, examples of the genus *Physa*, and *Neritina fluviatilis.* Dead shells and small pebbles are also found; but whether these last are taken up by the fish to serve any useful purpose, as in the stomachs of gallinaceous birds, or have only formed part of the cases of the *Phryganea*, may be questioned.

Some English authors have considered the Grayling a migratory fish, passing the winter in the sea, and the summer in fresh water. "Early in spring," says Mr. Donovan, "they ascend the rivers, where they remain till autumn, and then return to their former element." This may apply to Grayling on some parts of the European continent,* but is not the case certainly with our fish in this country, in the rivers of which it is found in the most perfect condition, and in consequence most eagerly sought after, in October and November. The finest specimens I ever saw were taken in November; and Sir H. Davy states in his "Salmonia," he had proved that the Grayling of England would not bear even a brackish water without dying.

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* Bloch says the Grayling descends to the Baltic in autumn.

The term *Thymallus* is said to have been bestowed upon this fish on account of the peculiar odour it emits when fresh from the water, which is said to resemble that of thyme; and from its agreeable colour as well as smell, St. Ambrose is recorded to have called the Grayling the flower of fishes. To be eaten in perfection, it cannot be dressed too soon. The name Grayling is supposed to be a modification of the words gray-lines, in reference to the dusky longitudinal bars along the body.

It has been considered that the large dorsal fin of the Grayling enabled it to rise and sink rapidly in deep pools; but this power would rather seem to be afforded by the large size of the swimming-bladder. The very large dorsal fin, compared to the small size of all the other fins, renders the Grayling unable to stem rapid currents: they are much more prone to go down stream than up, and are never seen leaping at a fall, like Trout.

In a Grayling of ten inches long, the length of the head is to the body alone as one to four; the depth of the body rather more than equal to the length of the head: from the point of the nose to the commencement of the dorsal fin is equal to one-third of the length of the whole fish to the end of the fleshy portion of the tail; the posterior edge of the dorsal fin half-way between the point of the nose and the end of the longest caudal rays; the adipose fin rather nearer the dorsal fin than the end of the tail: the height of the dorsal fin equal to half the height of the body, the first ray short, the next five increasing gradually in length;

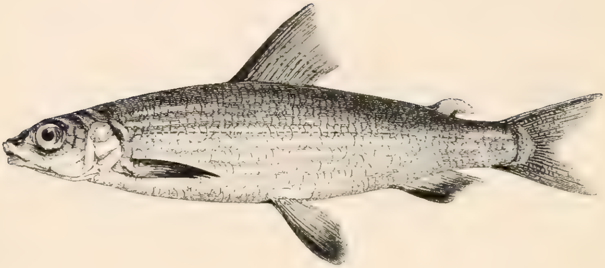
the sixth ray nearly as long as the seventh, and, as well as the five anterior rays, articulated and simple; the seventh ray and all the rays behind it articulated, branched, and nearly of the same height; the length of the base of the fin not equal to twice the length of its longest ray: the pectoral fin small, narrow, and pointed: the ventral fins commencing in a vertical line under the middle of the dorsal fin; the ventral axillary scale one-fourth of the length of the fin: the anal fin commences half-way between the origin of the ventral fin and the end of the fleshy portion of the tail, and ends on the same plane as the adipose fin above it; the longest ray but little longer than the base of the fin: the tail forked; the middle rays rather more than half as long as the longest. The fin-rays in number are—

D. 20 : P. 15 : V. 10 : A. 13 : C. 20. Vertebræ 58.

The head is small and pointed, flattened at the top: the breadth of the eye equal to one-fourth of the length of the whole head; irides golden yellow, pupil blue, pear-shaped, the apex directed forward: the opening of the mouth, when viewed in front, square; the teeth small, incurved, numerous; none on the tongue, and only a few on the most anterior part of the vomer: behind the head, the nape and back rise suddenly: the body deepest at the commencement of the dorsal fin, then tapering off to the tail; abdominal line but slightly convex; the scales rather large; the lateral line in the middle of the body not very conspicuous, with seven rows of scales on an oblique line above it, and seven rows below it; the sides marked with about fifteen dusky longitudinal bands. The general colour of the body light yellow brown, beautifully varied with golden, copper, green, and blue reflections when viewed in different lights, with a few decided dark spots: the head brown; on the cheeks and gill-covers a tinge of blue: all the fins somewhat darker than the colour of the body; the dorsal fin varied with square dusky spots on the membrane between the rays, the upper part of the fin spotted and streaked with reddish brown. The Grayling appears to become darker by age, and the pectoral fins are reddish about spawning time, with small black spots.

Switzerland also produces Grayling; I have therefore selected for the vignette a view of Mont Blanc.

ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.*



THE GWYNIAD.

SCHELLY. *Ulswater.*

Coregonus	*fera ?*		Cuvier, Règne An. t. ii. p. 307.
,,	,, ?		Nilsson, Prod. p. 16, sp. 4.
,,	,, ?		Jurine, pl. 7.
Salmo	*lavaretus,*	*Gwyniad,*	Penn. Brit. Zool. vol. iii. p. 419, pl. 73.
Coregonus	,,	,,	Flem. Brit. An. p. 182, sp. 50.
,,	,,	,,	Jenyns, Brit. Vert. p. 431.

Coregonus. *Generic Characters.*—Body in appearance herring-like; with two dorsal fins, the first higher than long, the second adipose; the scales large; the mouth small, sometimes with minute teeth on the jaws or tongue, or both.

The species of the genus *Coregonus* are numerous in Europe, and several of them are so similar to each other, that, without the power of comparing those of this country with foreign specimens, an appropriation of synonymes is at least doubtful. Some authors have even considered the Vendisse of Lochmaben as the same with the Powan of Perthshire, the Schelly of Ulswater, the Gwyniad of Wales, and the Pollan of Ireland: but it will be found that this is not the case; and, from recent observation, there is now reason to believe that the Pollan of Ireland is distinct from the two species of *Coregonus* found in Great Britain.

The Gwyniad of Wales was formerly very numerous in Llyn Tegid (Fair Lake), at Bala, until the year 1803, when Pike were put into the lake, which have very much reduced their numbers. Pennant considered the Gwyniad as the same with the *C. fera* of the Lake of Geneva, following in this the opinion of Willughby; and in the manuscript notes of a fishing tour in Wales, by two excellent fishermen, who had also pursued their amusement abroad, an opinion is given to the same effect. Our Gwyniad bears a close resemblance to the figure of *C. fera* in the illustrations to M. Jurine's Memoir on the Fishes of Lake Leman: his description I have not seen. The British fish accords also with the short description of the *C. fera* in Professor Nilsson's Prodromus of the Fishes of Scandinavia.

The Gwyniad is very numerous in Ulswater and other large lakes of Cumberland, where, on account of its large scales, it is called the Schelly. Dr. Heysham, the natural historian of Cumberland, and Pennant also, in his British Zoology, have recorded that many hundreds are sometimes taken at a single draught of the net. They are gregarious, and approach the shore in vast shoals in spring and summer. Pennant says, they die very soon after they are taken out of the water, are insipid in taste, and must be eaten soon, for they will not keep long. The poorer classes, who consider, and even call them the Fresh-water Herring, preserve them with salt. The fish is not unlike a Herring in appearance, and the Welsh term Gwyniad has reference to their silvery white colour. They spawn towards the end of the year, and the most usual length of the adult fish is from ten to twelve inches.

The length of the head is about one-fifth of the whole length of the fish; the depth of the body rather exceeding the length of the head: the dorsal fin commences about half-way between the point of the nose and the end of the fleshy portion of the tail; its longest ray one-third longer than the base of the fin, and equal to three-fourths of the depth of the body: the adipose fin rather nearer the end of the tail than the posterior edge of the dorsal fin; the pectoral fins narrow, pointed, and a little shorter than the head, inserted low down on the body: the ventral fins arising in a line under the middle of the dorsal fin; the ventral axillary scale one-third the length of the fin: the anal fin commences half-way between the origin of the ventral fin and the end of the short middle rays of the tail, and ends on the same plane with the adipose fin; the longest anterior ray about equal to the length of the base of the fin; the other rays diminishing gradually: the tail forked. The fin-rays in number are—

D. 13 : P. 17 : V. 11 : A. 16 : C. 19.

The head is triangular; the snout rather truncated; the jaws nearly equal, the lower just shutting within the upper; a very few minute teeth on the tongue only; the eyes large, the breadth more than one-fourth of the length of the head; the form of the body very like that of a Herring; the dorsal and abdominal lines but moderately convex; the scales large; the lateral line very near the middle of the side. The irides silvery, the pupils dark blue; the upper part of the head and back dusky blue, becoming lighter down the sides, with a tinge of yellow; cheeks, gill-covers, lower part of the sides and belly silvery white; all the fins more or less tinged with dusky blue, particularly towards the edges.

According to Mr. Thompson of Belfast,* the Pollan, or Lough Neagh *Coregonus*, differs from the Gwyniad of Bala in the following particulars : in the snout not being produced; in the dorsal fin being nearer the head ; in having fewer rays in the anal fin, and in its position being rather more distant from the tail ; in the dorsal, anal, and caudal fins being of less dimensions ; in the third ray of the pectoral fin being the longest, the first being of the greatest length in the Gwyniad ; and in the ventral axillary scale being longer.

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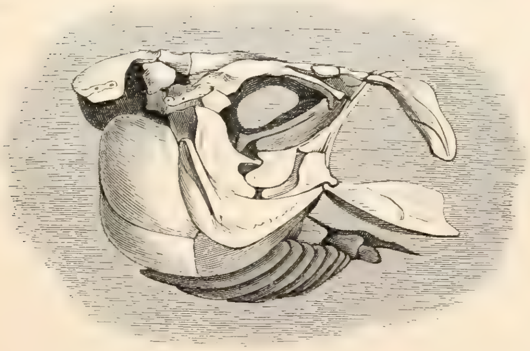
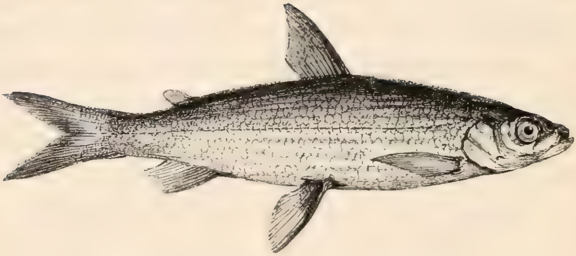
* Reports of Proceedings of the Zoological Society of London for 1835, p. 77.

The vignette represents the bones of the head in the genus *Coregonus*.



ABDOMINAL MALACOPTERYGII. *SALMONIDÆ.*



THE VENDACE, OR VENDIS.

Coregonus Willughbii, *Vendace*, Jardine, Illust. Scot. Salm. pl. 6.
,, ,, *Vangis and Juvangis*, Penn. Brit. Zool. vol. iii. p. 420.
,, ,, *Vendace*, Knox, Trans. R. S. E. vol. xii. p. 503.
,, *Marænula*, Jenyns, Brit. Vert. p. 432.

But little is known of this delicate fish beyond what has been published by Sir William Jardine, Bart. in the third volume of the Edinburgh Journal of Natural and Geographical Science, and by Dr. Knox, in the Transactions of the Royal Society of Edinburgh. Sir William Jardine, in his original communication, considered this species very closely allied to the *Salmo albula* of Linnæus; but the difficulty of fixing synonymes satisfactorily from the short descriptions of the older authors has since led to a request from him that the name of our distinguished British naturalist should be attached to it, and I with pleasure adopt the suggestion. I believe, however, that our Vendace is the *C. Marænula* and *C. albula* of Continental authors.

In Scotland the Vendace is only known in the lochs in the neighbourhood of Lochmaben, in Dumfries-shire; and in this district some traditions and curious opinions exist regarding it.

“ The Vendace is well known,” says Sir William Jardine, “ to almost every person in the neighbourhood ; and if, among the lower classes, fish should at any time form the subject of conversation, the Vendace is immediately mentioned, and the loch regarded with pride as possessing something of great curiosity to visiters, and which is thought not elsewhere to exist. The story that it was introduced into these lochs by the unfortunate Mary Queen of Scots, as mentioned by Pennant in his description of the Gwyniad,—and it is likely that his information was derived from this vicinity,—is still in circulation. That the fish was introduced from some Continental lake, I have little doubt ; but would rather attribute the circumstance to some of the religious establishments which at one time prevailed in the neighbourhood, and which were well known to pay considerable attention both to the table and the cellar. Mary would scarcely prefer a lake so far from even her temporary residence for the preservation of a luxury of troublesome introduction, and leave her other fish-ponds destitute of such a delicacy.”

“ An idea prevails that this fish, if once taken from the water, will die, and that an immediate return will be of no avail ; and it is also believed that it will not exist in any other water except that of the castle loch. These are of course opinions which have gradually, from different circumstances, gained weight, and have at last been received as facts. The fish is of extreme delicacy ; a circumstance which may have given rise to the first notion ; and the introduction of it must have taken place by means of the spawn : the fish themselves, I am confident, could not be transported alive even a few miles. As to the second opinion, they are not confined to the castle loch, but are found in several others, some of which have no communication with that where they are thought to be peculiar.”

“ In general habits the Vendace nearly resemble the

Gwyniad, and indeed most of the allied species of the genus. They swim in large shoals; and during warm and clear weather retire to the depth of the lakes, apparently sensible of the increased temperature. They are only taken with nets, a proper bait not being yet discovered; and the fact that little excrement is found in their intestines has given rise to another tradition, that they are able to subsist without food. They are most successfully taken during a dull day and sharp breeze, approaching near to the edges of the loch, and swimming in a direction contrary to the wind. They spawn about the commencement of November, and at this time congregate in large shoals, frequently rising to the surface of the water, in the manner of the common Herring, and making a similar noise by their rise and fall to and from the surface. The sound may be distinctly heard, and the direction of the shoal perceived, during a calm and clear evening. They are very productive. The lochs abound with Pike, of which they are a favourite food; but their quantity seems in no degree to be diminished, notwithstanding that immense numbers must be destroyed. They are considered a great delicacy, resembling the Smelt a good deal in flavour; and, though certainly very palatable, the relish may be somewhat heightened by the difficulty of always procuring a supply. During the summer, fishing-parties are frequent, introducing some stranger friend to this Lochmaben Whitebait; and a club, consisting of between twenty and thirty of the neighbouring gentry, possessing a private net, &c. meet annually in July, to enjoy the sport of fishing, and feasting upon this luxury."

While enjoying the hospitality of Sir William Jardine in the autumn of 1840, I had the gratification of seeing some Vendace caught in the morning, and afterwards partaking of them at dinner. I considered the fish quite entitled to all their character for excellence.

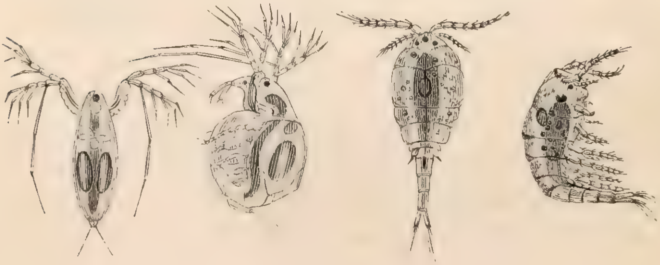
The circumstance that this fish is never caught by anglers made a knowledge of its food a matter of interest in several points of view. Dr. Knox ascertained that this consists principally of very minute entomostracous animals, not exceeding seven-twelfths of a line in size. I have been favoured with specimens of the Vendace by Sir William Jardine and T. S. Bushnan, Esq. which have afforded me several opportunities of examining the contents of the stomach and intestines. The contained mass, which is frequently in considerable quantity, has a brownish yellow colour, appearing slightly granulated to the unassisted eye. A very small portion being placed on a slip of glass, and agitated gently in conjunction with a drop of water, which separates the particles, on placing the slip of glass under a good microscope, two species in various states of perfection are almost constantly found. The vignette at the end of the description of this fish represents these two forms. The first and second figure on the left hand are a back and side view of a species of the genus *Lynceus* of Müller and others; the third and fourth figures are a back and side view of a species of *Cyclops* of Müller. On one occasion, I found a very small coleopterous insect, the tough skin of a red worm not much thicker than fine thread, and what appeared to be a portion of the wing of a dipterous insect.

Dr. Knox found that the females of the Vendace were more numerous as well as larger than the males, frequently exceeding eight inches in length; the males not measuring more than seven inches, which was the length of the specimen here described. They are seldom seen of larger size.

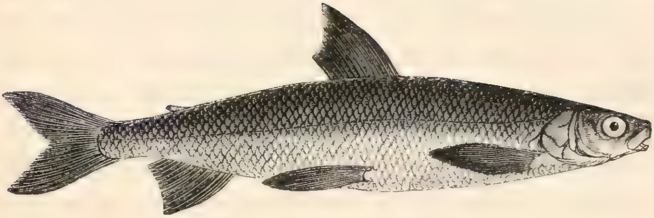
The length of the head compared to that of the body only was as two to seven; the depth of the body at the commencement of the dorsal fin not quite equal to one-fourth of the length of the body without the caudal rays: the body elegantly shaped; the convexity of the dorsal and abdominal lines about equal; the lateral line passes straight along the middle of the side, with six rows of scales in an oblique line between the dorsal fin and the lateral line, and the same number between the line and the ventral axillary scale: the dorsal fin commences half-way between the nose and the origin of the upper caudal rays; the longest ray double the length of the base of the fin: the adipose fin very near the tail; pectoral fin not quite equal to the length of the head; the ventral fin commences in a line under the first ray of the dorsal fin; the ventral axillary scale one-third the length of the fin; the anal fin commences half-way between the origin of the ventral fin and the end of the fleshy portion of the tail; the longest ray about equal to the base of the fin: the tail deeply forked; all the fins large. The fin-rays in number are—

D. 11 : P. 16 : V. 11 : A. 15 : C. 19. Vertebræ 52.

In form the under jaw is the longest; the mouth small, the opening square; a few very minute teeth on the tongue only: the breadth of the eye one-third of the whole head, the posterior part of the iris the broadest; the colour silvery tinged with yellow, the pupil blue: the upper parts of the body of a delicate greenish brown, shading gradually towards the belly into a clear silver; the dorsal fin a greenish brown; the lower fins are all bluish white.



ABDOMINAL MALACOPTERYGII. *SALMONIDÆ.*



THE POWAN.

Coregonus La Cepedei,	*The Powan,*	Parnell, Annals of Nat. Hist. vol. i. p. 161.
,, *clupeoides,*	*The Herring-like Coregonus,*	Lacepede, Hist. Nat. des Poiss. 8vo. edit. tom. x. p. 386.

Dr. Parnell, whose Ichthyological investigations in Scotland have not been confined to the "Fishes of the Forth" only, has described in the first volume of the Annals of Natural History a species of *Coregonus*, to which he has attached the name of *La Cepedei ;* this species having been first noticed, or perhaps distinguished, by this celebrated French naturalist. This fish is found in Loch Lomond, one of the largest and most picturesque lakes in the west of Scotland. It is not unlikely that some of the species of *Coregoni* found in the northern lakes of England, Scotland, and Ireland, may exist in the lakes of Scandinavia; M. Nilsson, Professor of Natural History at Lund, describing in his *Prodromus Ichthyologiæ Scandinavicæ* no less than eight species as belonging to that country: but from a certain general agreement in the characters of the *Coregoni*, it is difficult to refer our species with certainty in the absence of foreign specimens with which to make actual comparison.

It appears, on reference to his Natural History of Fishes, that Lacépède became aware of the existence of this *Coregonus* in Loch Lomond by the communication of M. Noel, who visited Scotland in August 1802. Although some little differences appear in the descriptions of this fish, as given by Lacépède and Dr. Parnell, there is little doubt that both authors had the same species under consideration. This fish bears, as observed by Dr. Parnell, considerable resemblance in appearance, and also in the number of its fin-rays, to the *Salmo Wartmanni* of Bloch, part 3, tab. 105, a species of *Coregonus*, named after a learned physician, who first described it. It is found in some of the lakes of Switzerland, and also in lake Constance; but Lacépède, to whom the *Wartmanni* was known, considered the Loch Lomond *Coregonus* distinct. It is thus described by Dr. Parnell, from a specimen fourteen inches in length.

"Head long and narrow, of an oval form, about one-fifth the length of the whole fish, caudal fin included; depth of the body between the dorsal and ventral fins less than the length of the head. Colour of the back and sides dusky blue, with the margin of each scale well defined by a number of minute dark specks; belly dirty white; the lower portion of the dorsal, pectoral, ventral, and anal fins dark bluish grey; irides silvery, pupils blue. First ray of the dorsal fin commencing half-way between the point of the snout and the base of the short lateral caudal rays; the first ray simple, the rest branched; the second and third the longest, equalling the length of the pectorals; the seventh ray as long as the base of the fin; the last ray one-third the length of the fourth; adipose fin large and thin, situate midway between the base of the fourth dorsal fin-ray and the tip of the long upper ray of the caudal fin ; anal fin commencing half-way between the origin of the ventral fin and the base of the middle caudal ray ; the first ray simple, the rest branched ; the second rather the longest ; the third as long as the base of the fin ; the last ray half the length of the fifth ; ventral fins commencing under the middle of the dorsal ; the third ray the longest, equalling the length of the same ray of the dorsal ; pectorals long and pointed, one-sixth the length of the whole fish, caudal fin included ; the first ray simple ; the second and third the longest, the last short, not one-fourth the length of the first ; tail deeply forked, with the long rays of the upper portion curving slightly downwards, giving the fin a peculiar form. Gill-cover produced behind ; the basal line of union between the operculum and suboperculum oblique ; the free margin of the latter slightly rounded ; preoperculum angular ; snout prominent, somewhat of a conical form, extending beyond the upper lip ; jaws of unequal length, the lower one the shortest. The maxillary bone broad, the free extremity extending back to beneath the anterior margin of the orbit. Teeth in the upper jaw long and slender, about six in number ; those on the tongue shorter and more numerous. Eyes large, extending below the middle of the cheeks ; lateral line commencing at the upper part of the operculum, and running down the middle of the sides to the base of the middle caudal ray. Scales large and deciduous, eighty-four forming the lateral line, eight between the dorsal fin and lateral line, and the same number between the lateral line and the base of the ventrals." The numbers of the fin-rays, including the two short rays at the commencement of the dorsal and anal fins, are

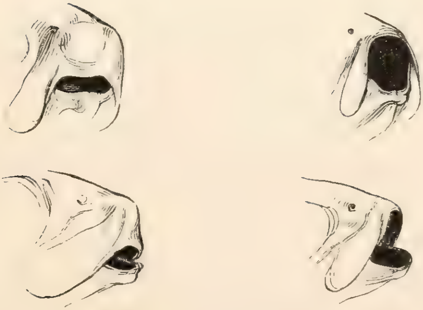
D. 14 : P. 16 : V. 12 : A. 13 : C. 20. Cæca 120.

"This fish grows occasionally to the length of sixteen inches. In the stomach of one of the specimens examined were found several species of *Entomostraca*, larvæ of insects, a few *Coleoptera*, a number of small tough red worms, little more than half an inch in length, and about the thickness of a coarse thread, besides a quantity of gravel, which the fish had probably accumulated when in search of the larvæ."

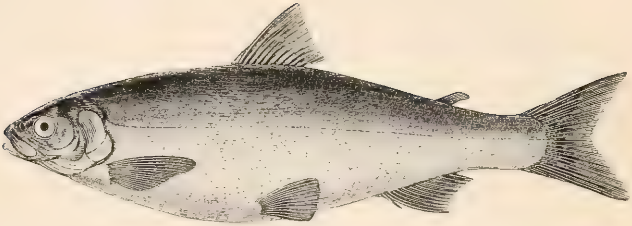
"These fish are found in Loch Lomond in great numbers, where they are called *Powans* or *Freshwater Herrings*. They are caught from the month of March until September with large drag-nets, and occasional instances have occurred in which a few have been taken with a small artificial fly: a minnow or bait they have never been known to touch. Early in the morning and late in the evening large shoals of them are observed approaching the shores in search of food, and rippling the surface of the water with their fins as they proceed. In this respect they resemble in their habits the Vendace of Lochmaben and the saltwater herring. They are never seen under any circumstances in the middle of the day. From the estimation these fish are held in by the neighbouring inhabitants, they are seldom sent far before they meet with a ready sale, and are entirely unknown in the markets of Glasgow. In the months of August and September they are in best condition for the table, when they are considered well flavoured, wholesome and delicate food. They shed their spawn in October to December, and remain out of condition until March."

Although agreeing in the number of fin-rays with the Pollan of Ireland, this Loch Lomond fish is at once distinguished from it by the peculiar form of its mouth, a representation of which, in two points of view, inserted as a vignette, and contrasted with the same parts in the Pollan, both of the natural size, will, better than description, convey the appearance in proof of distinction. The Loch Lomond fish being remarkable for the depth of the upper lip, and the large size of the lateral free portions of the superior maxillary bones.

Dr. Parnell has described a second species of *Coregonus* found in Loch Lomond, which differs from the first in having a smaller head, yet agreeing exactly in the number of all the fin-rays; but as I learn by communication with Dr. Parnell that since the publication of his paper he has obtained many specimens from Loch Lomond, the characters of which are intermediate in reference to the two fishes described, and appear to connect them, I have not figured it as a distinct species.



ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.*



THE POLLAN.

Coregonus Pollan, The Pollan, Thompson, Proceedings Zool. Soc. for 1835, p. 77; and Magazine of Zool. and Bot. vol. i. p. 247.

A short notice of the Pollan of Ireland, as made known by Mr. Thompson of Belfast in 1835, was inserted in the History of British Fishes, vol. ii. p. 88; and that gentleman having most zealously followed up his zoological investigations in that country, I am now enabled to add from his researches various further particulars.

"The earliest notice of the species that I have seen," says Mr. Thompson, "is in Harris's History of the County of Down, published in the year 1744, where, as well as in the statistical surveys of the counties of Armagh and Antrim, it has subsequently been introduced as one of the fishes of Lough Neagh, under the name of Pollan: but, as may be expected in works of this nature, little more than its mere existence is mentioned."

"The habits of this fish do not, with the exception of its having been in some instances taken with the artificial fly, differ in any marked respect from those of the Vendace of Scotland or the Gwyniad of Wales, and are in accordance with such species of Continental Europe as are confined to inland waters, and of whose history we have been so fully informed by Bloch. The Pollan approaches the shore in large shoals, not only during spring and summer, but when the autumn is far advanced. The usual time of fishing for it is in the afternoon, the boats returning the same evening. On the days of the 23rd, 24th, and 25th of September 1834, which I spent in visiting the fishing stations at Lough Neagh, it was along with the Common and Great Lake Trout, *Salmo fario* and *Salmo ferox*, caught plentifully in sweep-nets, cast at a very short distance from the shore. About a fortnight before this time, or in the first week in September, the greatest take of the Pollan ever recollected occurred at the bar-mouth, where the river Six-mile-water enters the lake. At either three or four draughts of the net, one hundred and forty hundreds,—one hundred and twenty-three fish to the hundred,*—or 17,220 fish were taken; at one draught more were captured than the boat could with safety hold, and they had consequently to be emptied on the neighbouring pier. They altogether filled five one-horse carts, and were sold on the spot at the rate of 3*s*. 4*d*. a hundred, producing 23*l*. 6*s*. 8*d*. From 3*s*. 4*d*. to 4*s*. a hundred has been the ordinary price at the lake side, or directly from the fishermen; some years ago it was so low as 1*s*. 8*d*. the hundred, but at that time the regular system of carriage to a distance, as now adopted, did not exist. At the former rates they are purchased by carriers, who convey them for sale to the more populous parts of the neighbouring country, and to the towns within a limited distance of the lake. They are brought in quantities to Belfast; and when the supply is good, the cry of 'fresh Pollan' prevails even to a greater extent than that of 'fresh Herring,' though both fishes are in season at the same period of the year. In the month of June 1834, fifty hundreds—six thousand one hundred and fifty individuals—of Pollan, and one hundred and twenty-five pounds weight of Trout, were taken at one draught of a net, at another part of the lake near Ram's Island, which was the most successful capture made there for twenty-four years. In 1834 this fish was more abundant than ever before known. Like the Gwyniad and Vendace, the Pollan dies very soon after being taken from the water, and likewise keeps for a very short time. It is not in general estimation for the table, but is, I think, a very good and well-flavoured fish."

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* The English long hundred is six score, or one hundred and twenty.

"Though permanently resident, the Pollan is very far from being generally diffused throughout Lough Neagh. It rarely occurs between the river Mayola and Toone; while from the Six-mile-water to Shane's Castle is so favourite a resort, that a few houses that formerly stood near the latter locality, were dignified with the name of Pollan's Town."

"In the months of November and December this fish deposits its spawn where the lake presents a hard or rocky bottom. On the 4th of December 1835, a quantity of the largest Pollans I have seen were brought to Belfast market. Several were thirteen inches in length, and all on dissection proved to be females just ready to deposit their roe. On the 11th of the same month several male specimens of full size that I procured, and which contained milt most prominently developed, measured but eleven inches and a half,—thus showing that in maturity the female fish exceeds the male in length in the proportion of thirteen to eleven and a half. Its average weight when in season is about six ounces. One specimen, mentioned to me as the largest taken within the last ten years, weighed two pounds and a half. The only food that I have, without resorting to the microscope, detected in the stomach of the Pollan, was a full-grown specimen of the bivalve shell *Pisidium pulchellum.* A pebble of equal size was also found with it." In the stomach of a specimen given me by Mr. Thompson I found a species of *Gammarus.* Mr. Thompson, in some more recent examinations, has found mature individuals of *Gammarus aquaticus*, and the larvæ of various aquatic insects; some shells of the genus *Pisidium*, one of the fry of the three-spined stickleback, and a few fragments of stone. Others were found to contain minute *Entomostraca*, two *Pisidia*, and a *Limneus pereger*; this last was three lines in length.

Besides inhabiting Lough Neagh, the Pollan has also been found in Lough Derg, an expansion of the Shannon; and Lord Cole, who has most condescendingly interested himself in the History of British Fishes, had the kindness to send me a jar full of Pollan from Lough Erne in the county of Fermanagh, from one of which specimens our figure was taken. The Pollan of Lough Erne are rather deeper for their length than those of Lough Neagh. His lordship has also sent me numerous Charr from Ireland; some from Lough Eask very much like the Charr of the Cumberland Lakes, while those from Lough Melvyn are short and deep fish with large fins exactly resembling the Charr found in two or three lakes in Wales, the particulars of which have been already described.

To return to the Pollan of Ireland, Mr. Thompson's description is as follows: "The relative length of the head to that of the body is about as one to three and a half; the depth of the body equal to the length of the head; the jaws equal in length, both occasionally furnished with a few delicate teeth; the tongue with many teeth; the lateral line sloping downwards for a short way from the operculum, and thence passing straight to the tail. Nine rows of scales from the dorsal fin to the lateral line, and the same number thence to the ventral fin, the row of scales on the back and that of the lateral line not included. The third ray of the pectoral fin the longest. The fin-ray formula is as follows—

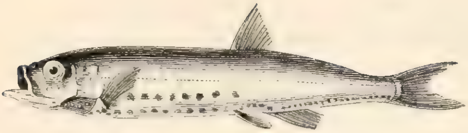
B. 9 : D. 14 : P. 16 : V. 12 : A. 13 : C. 19. Vertebræ 59.

Of these, the first two rays of the dorsal fin, and the first two rays also of the anal fin are short.

" The colour to the lateral line dark blue, thence to the belly silvery; dorsal, anal, and caudal fins, towards the extremity, tinged with black ; pectoral and ventral fins of crystalline transparency, excepting at their extremities, which are faintly dotted with black. Irides silvery, pupil black."

In a number of these Pollan from Lough Erne as well as Lough Neagh, the base of the last ray of the dorsal fin is exactly half-way between the point of the nose and the extreme end of the longest upper caudal ray. Nine rows of scales from the base of the first ray of the dorsal fin to the lateral line, and the same number from the lateral line to the origin of the ventral fin, with eighty-eight scales forming the lateral line. The fin-rays in number on several specimens exactly as stated by Mr. Thompson.

ABDOMINAL
MALACOPTERYGII. *SALMONIDÆ.*



THE ARGENTINE.

Scopelus Humboldtii, Cuvier, Règne An. t. ii. p. 315.
,, *borealis,* Nilsson, Prod. p. 20.
Serpes Humboldtii, Risso, Ich. p. 358, tab. X. f. 38.
Scopelus ,, ,, Hist. t. iii. p. 467.
Argentina sphyræna, *Argentine,* Penn. Brit. Zool. vol. iii. p. 432, pl. 76.
,, ,, ,, Flem. Brit. An. p. 182.
,, *Humboldti,* ,, Jenyns, Brit. Vert. p. 433.

Scopelus. *Generic Characters.*—Body long, slender; the principal dorsal fin over the interval between the ventral and anal fins; a second dorsal fin, so small as to be scarcely perceptible: the head short; the mouth and gill-aperture large; small teeth on both jaws; palate and tongue smooth.

At the time of publishing the first edition of this work, Pennant, and the Rev. Mr. Low of Orkney, appeared to be the only British observers who had met with, on our coast, examples of this brilliant little fish, which Cuvier considers to belong to the genus *Scopelus*, as here stated; and other references are here added, to assist in determining the species. The *Scopelus Humboldtii*, if identical with Pennant's Argentine, is taken to the north of our island, and also in the Mediterranean, as the remarks of Professor Nilsson and M. Risso imply; and the latter naturalist enumerates three species of the genus, of which he says *S. Humboldtii* is the best known, but that little is ascertained of their habits.

Pennant's specimen was taken in the sea near Downing in Flintshire: Mr. Low's fish was brought to him by a boy, who said he found it at the edge of the water among sea-weed. The receipt of an additional portion of MS. recently confided to me by William Walcott, Esq. furnishes a notice, written by his late father, of a third instance of the occurrence of the Argentine, which was found stranded on the shore near Exmouth: length two inches and a half. Pennant's description is, " Length two inches and a quarter; the eyes large, the irides silvery; the lower jaw sloped much; the teeth small; the body compressed, and of an equal depth almost to the anal fin; the tail forked: the back was of a dusky green; the sides and covers of the gills as if plated with silver; the lateral line was in the middle, and quite straight: on each side of the belly was a row of circular punctures; above them another, which ceased near the vent." The formula of the fin-rays appears to be—

D. 9 : P. 17 : V. 8 : A. 15 : C. 19.

The figure of this fish referred to in M. Risso's work represents the anal fin as containing many more rays than are apparent in the figure by Pennant, from which the representation at the head of this article is copied.

In the volume of the Magazine of Natural History for the year 1838, Dr. W. B. Clarke, who had found a specimen of the Argentine at Portobello, near Edinburgh, has published a notice of his fish, from which the following is an abstract.

" I beg leave to transmit, for insertion in the Magazine of Natural History, a sketch and description of a species of Argentine, which I obtained upon the shore of the Frith of Forth, at Portobello, in April 1833.

" I discovered this highly elegant little fish, whilst looking amongst the various bodies cast up by the water, and observed it lying entangled in some sea-weed, which had been accumulated in masses, and left by the retiring tide. The fish was dead; but from its freshness could not long have been so.

" In the Animal Kingdom of Cuvier, translated by Griffith, we have the following description of the genus :—

" *Scopelus*, Cuv. *Serpes* of Risso.

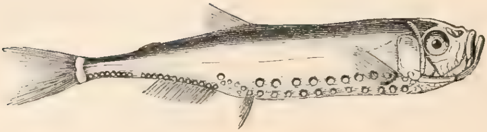
" ' Mouth and gills extremely cleft ; the two jaws furnished with very small teeth ; the edge of the upper entirely formed by the intermaxillaries ; the tongue and palate smooth. —Their muzzle is very short and obtuse : there are nine or ten rays to the gills ; and besides the usual dorsal, which corresponds to the interval of the ventrals, and the anal, there is another very small one behind, in which the vestiges of rays are perceptible.'

" ' These fishes are caught in the Mediterranean, intermingled with the Anchovies, and they are there called Melettes, as are other small fishes. One of them, the *Serpes Humboldtii*, Risso, pl. x. fig. 38, is remarkable for the brilliancy of the silvery points which are distributed along the body and tail.'

" Then in a note we have, ' I believe this fish to be the pretended *Argentina sphyræna* of Pennant's Brit. Zool. No. 156; therefore it should be found in our part of the Atlantic.'

" Besides the *Scopelus Humboldtii*, which probably is identical with the species under description, there are two other species, viz. *Serpes* (*Scopelus*) *crocodile*, Risso, p. 357, and *Serpes* (*Scopelus*) *balbo*, Id. Ac. des Sc. de Turin, tome xxv. pl. x. fig. 3.

" Pennant's description agrees, in many respects, with my fish; but as the figure contained in Mr. Yarrell's work,



(which was taken from Pennant's,) differs very materially about the head and tail, although it resembles it in the form of the body, I have sent an exact figure of my own specimen, to show the precise form of the bones of the opercula and sides of the head, together with a full description; which may assist future observers in determining whether more than one species visits our shores. If Pennant's figure be an exact representation, the fish it was taken from was certainly a different species to the one under description.

" My specimen would correspond with Pennant's description except in the following particulars: viz. length one inch $\frac{15}{16}$: the back of a dense blue black, presenting, in certain lights, a brownish tinge; lateral line central and straight, but inclining upwards, at about its anterior sixth, towards the upper angle of the operculum.

" The number and arrangement of the guttæ in the specimen under consideration, are as follow: viz. on each side, upper series between os hyoides and origin of pectoral fin, five; upper abdominal series between base of pectoral and a spot perpendicularly over the ventral, nine; lower abdominal series, from a spot perpendicularly beneath the posterior margin of orbit, to base of ventral, twelve; between base of ventral and commencement of anal, six; the two anterior directed downwards and backwards; the four posterior forming an arch from a little above the second gutta to the commencement of the anal fin: one large gutta, in a line with the upper abdominal series, is placed slightly anterior, but above the commencement of the anal fin: between the anterior commencement of anal and base of caudal, twenty-four; but between the eighth and ninth from the caudal fin, there is a space where a spot appears to have been obliterated.

"About midway between the anterior commencement of the dorsal and base of caudal, but rather nearer the latter, there is a slight elevation, where, apparently, the fleshy fin has its origin; but in the specimen under description it is scarcely perceptible, being, even with the aid of a lens, only like a slight membranous ridge.

"The formula of the fin-rays appears to be—

D. 9 : P. 17 : V. 8 : A. 20 : C. 18.

Mr. Yarrell remarks, 'the figure of this fish, referred to in Risso's work, represents the anal fin as containing many more rays than are represented in the figure by Pennant.' The fish obtained by me possesses more anal rays than Pennant's would appear to have had, judging from the figure which he has published.

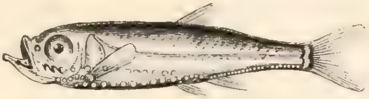
"Length of head compared with whole length of fish, as one to four: diameter of eye to length of head, as one to three: first dorsal fin commences midway between end of nose and tail: depth of body to whole length of fish, as one to five and a half: nostrils double, situated in a depression midway between the eye and centre of intermaxillary bone. The operculum is extremely large, and appears to be developed at the expense of the pre-operculum, which is very small, and joins the former by a straight moveable suture, running in a line perpendicularly downwards, from the posterior margin of the orbit; it forms an obtuse-angled triangle, with the obtuse angle pointing downwards and backwards:

the sub-orbital bone occupies nearly the anterior inferior half of the orbit, and is of a beautiful argenteous lustre, like the operculum. There are five oval spots, forming a fan-shaped figure, occupying the space between the anterior edge of the superior maxillary bone, and the anterior inferior angle of the pre-operculum, beneath the sub-orbital bone, and distinctly seen through the transparent intermaxillary bone, which is very large. There is one gutta upon the pre-operculum, at its anterior inferior angle, and the appearance of another at the anterior inferior angle of the sub-operculum: there is no appearance of branchiostegous rays whilst the opercula are closed.

" The sides of this elegant little fish are of the most resplendent argenteous lustre; the guttæ are of a dense opaque white, and round their margin, especially along the subcaudal series, there is a steel-blue tinge, giving that part of the body a very beautiful appearance. The upper abdominal series have an arched appearance, from this tinge not being continued round the inferior margin of the guttæ. The back of the specimen under description, which has been in spirits ever since its capture, is of a dense blue black, presenting, in certain lights, a brownish tinge.

" From specimens of this fish having been found in the above localities, viz.—in the sea near Flintshire, on the shore in Orkney, in Devonshire, and, lastly, in Edinburghshire, we may infer that it is generally, although sparingly, diffused through the British seas. Probably, ere long, we may hear of other examples of its occurrence upon our shores, or in our seas."

So recently as March last, 1841, and while the preceding part of the present volume was going through the press, I received a letter from the Rev. J. Newsam, of Redcar, on the Yorkshire coast, informing me that a specimen of the Argentine had been found by one of his children amongst sea-weed on the shore, about high-water mark, the colours of which were most brilliant, and both rows of spots very distinct. This gentleman also sent me word that one or two other specimens had been obtained, at different times, in the same vicinity, near Redcar. The specimen preserved was given to me by Mr. Newsam, and I beg to record my thanks for his kindness in sending me the first example of the fish I ever saw. From this specimen the representation here inserted was carefully drawn and engraved, exactly of the natural size.

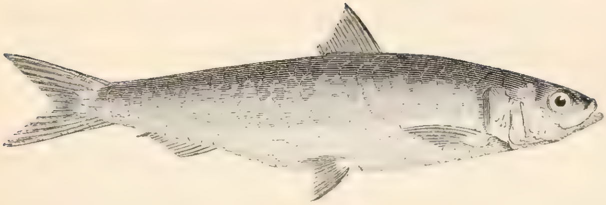


In May last I received a letter from the Rev. T. S. Rudd, also of Redcar, stating that he had found a brilliant specimen of the Argentine, of which a fisherman, when it was shown to him, observed, that he had seen several like it cast up on the shore. This example, which Mr. Rudd sent for my inspection, with a request that I would keep it if of any use to me, exactly agreed with the specimen already in my possession. Prince Canino, during his recent visit to this country, said, on seeing my example of this fish, that he had not found this species in the Mediterranean, most of which are figured and described in the 27th part of the *Fauna Italica.*

Both the specimens from Redcar having suffered some slight mutilation, I was unable to decide the number of rays in the dorsal, ventral, or anal fins; which would have assisted in determining the species. In the character of the fins, the Yorkshire specimens most resemble Pennant's figure at the head of this article; in the number and situation of the spots, and in colour, they resemble Dr. Clarke's fish; and there is a general resemblance in all three, except in size. By endeavouring to represent the steel-blue appearance along the lower edge of the fish, the silvery spots are rendered more apparent. Other examples, I have no doubt, will hereafter occur to decide the question, whether only one, or more species, inhabit our shores.

ABDOMINAL
MALACOPTERYGII.

CLUPEIDÆ.[*]



THE PILCHARD.

GIPSEY HERRING. *Scotland.*

Clupea pilchardus, Bloch, pt. xii. pl. 406.
,, ,, Willughby, p. 223, tab. P. 1. fig. 1.
,, ,, Cuvier, Règne An. t. ii. p. 319.
,, ,, *Pilchard,* Penn. Brit. Zool. vol. iii. p. 453, pl. 79.
,, ,, ,, Don. Brit. Fish. pl. 69.
,, *pilcardus,* ,, Flem. Brit. An. p. 183, sp. 52.
,, ,, ,, Jenyns, Brit. Vert. p. 436.

Clupea. *Generic Characters.*—Body compressed; scales large, thin, and deciduous; head compressed; teeth minute, or wanting; a single dorsal fin; abdominal line forming a sharp keel-like edge, which in some species is serrated; branchiostegous rays 8.

The following account of the Pilchard is derived from the MS. of Mr. Couch, from whose various scientific acquirements, habits of observation and locality, it may be fairly inferred that no better authority could be quoted.

The older naturalists considered the Pilchard, like the Herring, as a visiter from a distant region; and they assigned to it also the same place of resort as that fish, with which indeed the Pilchard has been sometimes confounded. To this it will be a sufficient reply, that the Pilchard is never seen in the Northern Ocean, and the few that sometimes wander through the Straits of Dover, or the Bristol Channel, have evidently suffered from passing so far out of their accustomed limits. They frequent the French coasts, and are seen on those of Spain; but on neither in considerable numbers, or with much regularity; so that few fishes confine themselves within such narrow bounds. On the coast of Cornwall they are found through all the seasons of the year, and even there their habits vary in the different months. In January, they keep near the bottom, and are chiefly seen in the stomachs of ravenous fishes; in March, they sometimes assemble in schulls, and thousands of hogsheads have in some years been taken in seans: but this union is only partial, and not permanent; and it is not until July that they regularly and permanently congregate so as to be sought after by the fishermen.

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[*] The family of the Herrings.

The sean-fishery commences in August, and continues until the shortened days and stormy weather of the equinox render its further prosecution impracticable; but the fish continue to appear, sometimes in great numbers, until the conclusion of the year. The season and situation for spawning, and the choice of food, are the chief causes which influence the motions of the great bodies of these fish; and it is probable that a thorough knowledge of these would explain all the variations which have been noticed in the actions of the Pilchard, in the numerous unsuccessful seasons of the fishery. In some years, at least, a considerable body of Pilchards shed spawn in the month of May—perhaps in the middle of the Channel, where I have known them taken, heavy with roe, in drift-nets shot for Mackerel; yet it seems certain that they do not breed twice in the year, and that the larger body do not perform this function until October, and then at no great distance from the shore. I have known an equally great variation to occur in other fishes, which have in consequence visited us, and been in season, at a time not expected by the fishermen.

They feed with voracity on small crustaceous animals; and I have found their stomachs crammed each with thousands of a minute species of shrimp, not larger than a flea. It is probably when they are in search of something like this, that fishermen report they have seen them lying in myriads quietly at the bottom, examining with their mouths the sand or small stones in shallow water. The abundance of this food must be enormous, if, as there can be no doubt was the case, all the schulls on the coast were as well fed as the individuals I examined. The Pilchard has been known to swallow a hook baited with a worm; and it is probable that they devour the roe of fish; for a gentleman who resided on the shores of the Bay of Biscay informed me that it is the custom of the French fishermen to throw large quantities of the salted pea-roe of fish about their nets, to attract Pilchards, and that he has seen much of this spawn in the stomachs of Pilchards so taken. Large quantities of the roe of fish are imported into France for this purpose from northern nations.

When near the coast, the assemblage of Pilchards assumes the arrangement of a mighty army, with its wings stretching parallel to the land; and the whole is composed of numberless smaller bodies, which are perpetually joining together, shifting their position, and separating again. There are three stations assumed by this great body, that have their separate influence on the success of the fishery. One is to the eastward of the Lizard, the most eastern extremity reaching to the Start Point in Devonshire, beyond which no fishery is carried on, except that rarely it extends to

Dartmouth; a second station is included between the Lizard and Land's End; and the third is on the north coast of the county, the chief station being about St. Ives. It is common for one of these districts to be full of fish, while in neither of the others is a schull to be seen; but towards the end of the season they often move from one station to another, or perhaps traverse in succession all the shores of the county. The subordinate motions of the schulls are much regulated by the tide, against the current of which they are rarely known to go; and the whole will sometimes remain parallel to the coast for several weeks, at the distance of a few leagues, and then, as if by general consent, will advance close to the shore, sometimes without being discovered till they have reached it. This usually happens when the tides are strongest, and is the period when the principal opportunity is afforded for the prosecution of the sean-fishery.

The fishery for Pilchards is carried on by drift or driving nets, and with seans. The outfit of the former, which somewhat resembles that already described for Mackerel, consists of a number of nets, great in proportion to the wealth of the proprietor and the size of the boat, but commonly about twenty, each from eighteen to twenty fathoms long, and seven fathoms deep; so that a string of driving nets will sometimes reach three-quarters of a mile. These nets are fastened to each other in length, and to a head-line, appropriated to each, along which runs a row of corks; another line runs loosely along the middle of the nets to afford additional strength, but no lead is used at the bottom. The nets are carried in common fishing-boats, some of which, as at Mount's Bay, are luggers, and most of the others have spritsails: the crews consist each of four men and a boy. The fishery begins a little before sunset, and the nets are drawn in about two hours, to be again shot as morning approaches; for Pilchards enter the nets better at these seasons. A rope from one end of the string is fastened over the quarter of the boat, and the nets are left to float with the tide, no sails being set, except rarely in very calm weather, to prevent the nets being folded together. Within a few years an improvement has been made, derived, it would appear, from the practice of the herring-fishers, by which more fish have been taken, and much of the hazard obviated to which the nets were exposed by ships passing over them. It consists in diminishing the number and size of the corks along the head-line, and in fixing cords at proper distances, each of which has attached to it a stout buoy. These cords are from two to two and a half fathoms long, and consequently allow the upper edge of the nets to sink to that depth below the surface; but even now it is found that the fish are principally caught in the lower part of the net.

The number of fish taken by a drift-boat in a night's fishing varies exceedingly: from five to ten thousand is considered moderate; it often amounts to twenty thousand. For the season's fishing, about one hundred and fifty thousand fish would be deemed favourable.

For the sean-fishing, three boats are provided, of which two are about forty feet long, and ten wide at the beam, with flat timbers and a sharp bow. The first is termed the sean-boat, and is furnished with a sean two hundred and twenty fathoms in length, and twelve fathoms deep, which is buoyed along the head-rope with corks, and weighed down with leads. The second boat is called the volyer, a term supposed to be a corruption of the word, follower. This boat has a sean from one hundred to one hundred and twenty fathoms in length, and eighteen fathoms deep at its deepest part, and is termed the tuck-sean: it differs from the former, called the stop-sean, as well in shape as in dimensions, the middle being formed into a hollow or bunt.

A third boat, called a lurker, is less than the others, and has no sean. The crew attending a sean consists of eighteen men and one or two boys. Seven of these are assigned to each of the larger boats, and the remaining four, including the master seaner, to the lurker. This fishery commences in August, three weeks or a month after the drivers, whose success, or the want of it, has much influence. The three boats proceed in the afternoon to some sandy bay, and cast anchor, keeping a good look-out for the appearance of fish, which are discovered either by the rippling of the water, by the stoiting or leaping of the fish, or by the colour they impart to the sea. In these respects, as marks of the difference between the habits of the Herring and the Pilchard, fishermen observe that the former rarely springs from the water, or stoits, as it is called, except when alarmed or driven: but the Pilchard does this often, and apparently from wantonness. When alarmed, both these fish will rush along the distance of five or six feet, as marked by the briming;* but the Pilchard does this with more celerity than the Herring.

When the presence of fish is discovered, the lurker proceeds to the place to ascertain the magnitude of the schull, and the direction in which it is moving. The depth of water, clearness of ground from rocks and other obstructions, and the force and direction of the tide, enter also into the calculation of the master before he makes the signal for preparation. All the proceedings are directed by signs, for the fish are alarmed at noise, and when everything is favourable, a warp from the end of the sean is handed to the volyer, whose place it is to keep all taut; the lurker continuing on the fish to watch their motions, and to point to the sean-boat what is to be enclosed. The sean-boat is rowed by four men, the other three being employed in throwing the net; and such is the vigour exerted on this occasion, that this great body of net, rope, corks, and lead is thrown into the sea in less than five minutes. The sean at first forms a curved line across the course of the fish; and while the two larger boats are employed in warping the ends together, the lurker's station is in the opening, where, by dashing the water, the fish are kept away from the only place of escape. When the sean is closed and the ends are laced together, if the body of the fish be great and the sea or tide strong, the net is secured by heavy grapnels, which are attached to the head-ropes by hawsers. It will appear from this account that it is not more difficult to take a thousand hogsheads of fish than a single hogshead; the only difference being, that with the greater quantity the sean is regularly moored, which with the smaller is unnecessary: it may even be said that the capture of the larger body is most easily effected; for, as its motion is slow, its course is not so speedily altered.

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* The flash of light seen in the sea when disturbed in the night, and supposed to proceed from minute molluscous or crustaceous animals.

When the evening has closed in, and the tide is low, they proceed to take up the fish. For this purpose, leaving the stop-sean as before, the volyer passes within it, and lays the tuck-sean round it on the inner side: it is then drawn together so as gradually to contract the limits of the fish, and raise them from the bottom. When disturbed, they become exceedingly agitated; and so great is the force derived from their numbers and fear, that the utmost caution is used lest the net should either sink or be burst. When the tuck-sean is thus gradually contracting and the boats surround it, stones suspended from ropes, called minnies, are repeatedly plunged into the water at that part where escape alone is practicable, until the fish then to be taken up are supported in the hollow or bunt of the sean.

When brought to the surface, the voices of the men are lost in the noise made by the fish as they beat the water.

The seaners fix themselves in pairs on the gunwales of the boats, with flaskets to lade the fish on board. When the quantity enclosed in the stop-sean is large, the tuck-sean is made to enclose no more than the boats can carry, of which a master seaner commonly forms a correct judgment by the extent of the briming in his sean, as the fish move in it; and many advantages result from taking up only a portion at one time, for the whole can thus be salted in proper condition, without fatigue or extraordinary expense: thus a week may possibly elapse before the whole of the capture is secured, part being taken up every night.

The description here given of the manner in which the Pilchard fishery is conducted applies to the greater part of the coast, but some variation occurs in particular districts. In Mount's Bay the men and boats employed to take the fish are not the same that convey it to land; a mode of proceeding rendered necessary by the distance from shore at which it is taken. The fishery at St. Ives is regulated by a particular act of parliament, and huers* are employed there and elsewhere to assist the fishermen. The sean-fishery, as practised formerly, resembled that carried on at St. Ives; and in one of Norden's maps is a representation of the taking of Pilchards by means of a sweep-net, of which one end continues near the shore, as then employed in St. Austle's Bay. The capture was drawn on shore in the mode now used with ground-seans for other fish, and consequently none could be taken unless they approached near to an open beach; and one end of a sean is now termed the pole end, from the pole shod with lead then used to elevate and spread the part to which the warp was attached.

Old and experienced fishermen have stated as the result of long observation, that, besides the well-known fact of the fish being most abundantly taken within a few days after the spring-tides, the direction of the tide has great effect on the motions of the schull. Its progress is always towards the same point, and in drift-nets all the heads of the fish point in one way, unless the tide has turned while the nets were afloat. In a bay where the tide comes round a headland and circles the bay, the fish take the same route, and a man aware of this may know in what direction to watch, and whither the schull is proceeding; and as, especially when the tide is rapid, he must be careful that the sean is not carried on the back of the schull, the net must be so shot as to have the benefit of the tide, and yet be laid across the front of the fish. A schull will not turn back directly contrary to its former course, although, when alarmed, its direction may be considerably changed. In the open sea, drift-nets are commonly cast in the direction of the tide, because the nets are most easily kept in that course; but when near land, or the entrance of a bay, a favourite position is parallel to it, by which the fish are intercepted in their advance or retreat. I have seen drift-boats shoot their nets in the midst of a multitude of fish, one in the direction in which they were going, and another across their course, and in less than two hours the second had taken nine thousand, the other not a fish; and yet the boats frequently prefer the first plan. The most successful time for the drift-net fishery is during hazy nights, with some motion of the wave, for the fish then enter the nets freely, whereas in clear moonlight they are shy; and in very dark nights such is the brightness of the briming, that the nets look like a wall of fire, and deter the fish.

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* Huers are men posted on elevated situations near the sea, who by various concerted signals, made with a bunch of furze in each hand, direct the fishermen how best to surround a schull of fish.

As an object of adventure, the Pilchard fishery is popular in Cornwall, and beyond a doubt the community is greatly benefited by it; yet it frequently happens that the success is partial, and the price low; and it may be questioned whether in any year the greater part of the seans obtain more than their expenses: but when there is a profit, it is commonly considerable, and in this lottery every one is led by the hope of being among the fortunate.

The following is a statement, perhaps nearly approaching to the truth where absolute certainty is unattainable, of the amount of property engaged in the Pilchard fishery in the year 1827, when the bounty began to be withdrawn:—Number of seans employed, 186; not employed, 130; total number of seans, 316: number of drift-boats, 368: men employed on board drift-boats, 1600; number of men employed on seans at sea, 2672; number of persons on shore to whom the fishery affords direct employment, 6350; total number of persons employed in the fishery, 10,521: cost of seans, boats, &c. used in the fishery, 209,840*l.*; cost of drift-boats and nets, 61,400*l*; cost of cellars for curing, and other establishments on shore for carrying on the fishery, 169,175*l.*; total capital invested directly in the Pilchard fishery, 441,215*l.* The outfit of a sean amounts to about 800*l.*; a string of drift-nets will cost about 6*l.* the net; and the boat from 100*l.* to 150*l.*; but this is used throughout the year for the other purposes of fishing. The nets are supposed to last about six years, and ought, of course, to produce their own value within that time, together with an adequate profit; but it is the complaint of the fishermen that this is not the case. The profit of the men depends on the share of the fish, which is divided into eight parts, of which the boat has one-eighth part, the nets three, and the men four: a boy that accompanies them is rewarded with the fish that may fall into the sea as the nets are drawn, to secure which he is furnished with a bag-net at the end of a rod, termed a keep-net.

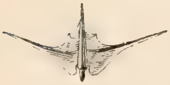
The quantity of Pilchards taken is sometimes incredibly large. A fisherman now alive was present once at the taking of two thousand two hundred hogsheads of Pilchards in one sean; but the greatest number heard of as taken at one time is stated by Borlase at three thousand hogsheads; in reference to which Pennant has made an astounding error, in reckoning by mistake thirty-five thousand fish to a hogshead, instead of three thousand five hundred. The number since allowed has been three thousand, and is now two thousand five hundred fine fish; but it is scarcely necessary to say that they are not counted. An instance has been known where ten thousand hogsheads have been taken in one port in a single day, thus providing the enormous multitude of twenty-five millions of living creatures drawn at once from the ocean for human sustenance.

The different modes of curing the fresh fish are detailed elsewhere. The various ports on the northern shore of the Mediterranean are the principal places to which the preserved fish are exported.

Our term Pilchard is said to be derived from *Peltzer*, a name by which this fish was known to some early Northern Continental authors. A few Pilchards make their appearance occasionally in the Forth about October, generally preceding the Herrings; but the great shoals appear to belong almost exclusively to our south-western shores. They are seldom seen east of Devonshire; but in August 1834 a shoal of Pilchards were observed in Poole Harbour, and so many fish were taken that they were sold in the market at a penny a dozen. In May 1838 I obtained one Pilchard in the Thames.

Smith's History of the County of Cork contains a full and interesting account of the Pilchard fishery in Bantry Bay. They have been noticed also on the coast of the county of Cork, and taken at Dublin and Belfast. On our eastern coast, a few are taken every year at Yarmouth with the Herrings. They were more than usually abundant there in the years 1780, 1790, and 1799.

Specimens of the Pilchard sometimes measure eleven inches in length; the fish described measured nine inches. It much resembles the Herring, but is smaller and thicker. The length of the head is to the whole length as one to five; the depth of the body equal to the length of the head; the transverse thickness of the body equal to half its depth: the form of the head triangular, the upper surface flat; the dorsal and abdominal lines slightly and equally convex; no perceptible lateral line; the body across the back obtusely rounded; the line of the abdomen smooth; the edges of the scales of the two sides leaving a longitudinal groove from the branchiostegous rays to the vent, along which groove extends a row of scales of a peculiar shape, of which the woodcut here placed is a representation; the two long narrow lateral arms extending up each side under the scales, the shortest projection pointing backward: the scales of the body are very large, deciduous, and ciliated at the free edge.



The distance from the point of the nose to the base of the last ray of the dorsal fin, and from thence halfway along the caudal rays, nearly equal: the commencement of the dorsal fin is therefore anterior to the middle of the fish by the whole length of the base of the fin; the first and second rays shorter than the third, which is equal to the length of the base of the fin; these first three rays articulated, but simple; all the other rays branched: pectoral and ventral fins small, the latter commencing in a line under the middle of the dorsal fin ; the axillary scales very long : the anal fin commencing half-way between the origin of the ventral fins and the end of the fleshy portion of the tail ; the first ray short, the second and the last two rays the longest : the tail deeply forked ; the scales at the end of the fleshy portion of the body extending far over the bases of the caudal rays, particularly two elongated scales above and below the middle line. The fin-rays in number are—

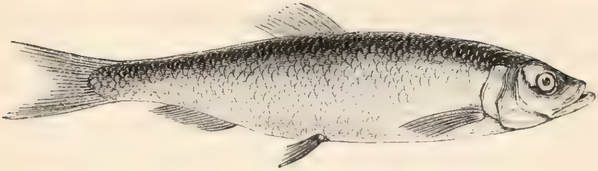
D. 18 : P. 16 : V. 8 : A. 18 : C. 19. Vertebræ 55.

The mouth is small, without teeth, the under jaw the longest : the breadth of the eye one-fourth of the length of the head, and placed at rather more than its own breadth from the point of the nose ; the irides yellowish white : the cheeks and all the parts of the gill-covers tinged with golden yellow, and marked with various radiating striæ : the posterior edge of the operculum nearly vertical and straight : the upper part of the body bluish green ; the sides and belly silvery white ; the dorsal fin and tail dusky. Mr. Couch says the Pilchard is sometimes found with a row of spots on the side, like the Shad ; which seems the result of disease, these fish being small, soft, and unfit for curing.

As an appropriate conclusion to this account of the Pilchard fishery of Cornwall, derived principally from the MS. of Mr. Couch, the vignette at the bottom of the next page is a representation of the harbour of Polperro, near which Mr. Couch has long resided : and I take this opportunity of recording my obligations to that gentleman, not only for his great liberality in allowing me the unlimited use of his voluminous MS. of the Natural History of the Fishes which have been found on the coasts and in the rivers of Cornwall, with an extensive series of characteristic drawings, but also for the warm interest and substantial support afforded to this work during its progress.

While this sheet was going through the press, the London newspapers noticed the appearance of numerous large shoals of Pilchards on the south coast of Ireland, which the poor fishermen were unable to take advantage of from the want of proper nets and salt.

ABDOMINAL
MALACOPTERYGII. *CLUPEIDÆ.*



THE HERRING.

Clupea harengus,		LINNÆUS. BLOCH, pt. i. pl. 29.
,,	,,	WILLUGHBY, p. 219, pl. P. 1, fig. 2.
,,	,,	*Herring,* RAY, Syn. p. 103.
,,	,,	CUVIER, Règne An. t. ii. p. 317.
,,	,,	*Herring,* PENN. Brit. Zool. vol. iii. p. 444, pl. 79.
,,	,,	,, FLEM. Brit. An. p. 182, sp. 51.
,,	,,	,, JENYNS, Brit. Vert. p. 434.

ANDERSON and Pennant were certainly mistaken in supposing that the great winter rendezvous of the Herring is within the Arctic Circle: "there they continue," says Pennant, "for many months, in order to recruit themselves after the fatigue of spawning; the sea within that space swarming with insect food, in a degree far greater than in our warmer latitudes."

"This mighty army begins to put itself in motion in the spring. We distinguish this vast body by that name; for the word Herring is derived from the German *Heer*—an army, to express their numbers. They begin to appear off the Shetland Islands in April and May.* This is the first check this army meets with in its march southward. Here it is divided into two parts: one wing of those destined to visit our coasts takes to the east, the other to the western shores of Great Britain, and fill every bay and creek with their numbers; others proceed towards Yarmouth, the great and ancient mart of Herrings; they then pass through the British Channel, and after that in a manner disappear. Those which take to the west, after offering themselves to the Hebrides, where the great stationary fishery is, proceed towards the north of Ireland, where they meet with a second interruption, and are obliged to make a second division: the one takes to the western side, and is scarcely perceived, being soon lost in the immensity of the Atlantic; but the other, which passes into the Irish Sea, rejoices and feeds the inhabitants of most of the coasts that border on it. These brigades, as we may call them, which are thus separated from the greater columns, are often capricious in their motions, and do not show an invariable attachment to their haunts."

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* In another part of his account, Pennant says the Herrings continue on the Welsh coast till February. (P. 447.)

This is Pennant's account as it regards our own islands. To show that this supposed migration to and from high northern latitudes does not exist, it is only necessary to state, that the Herring has never been noticed, that I am aware, as abounding in the Arctic Ocean: it has not been observed in any number in the proper icy seas; nor have our whale-fishers or arctic voyagers taken any particular notice of them. There is no fishery for them of any consequence either in Greenland or Iceland. On the southern coast of Greenland the Herring is a rare fish; and only a small variety of it, according to Crantz, is found on the northern shore. This small variety or species was found by Sir John Franklyn, on the shore of the Polar basin, on his second journey.

"That the Herring is, to a certain degree, a migratory fish," says Dr. M'Culloch,* "may be true; but even a much more limited migration is far from demonstrable. It is at any rate perfectly certain that there is no such progress along the east and west coasts from a central point." There can be no doubt that the Herring inhabits the deep water all round our coast, and only approaches the shores for the purpose of depositing its spawn within the immediate influence of the two principal agents in vivification—increased temperature and oxygen; and as soon as that essential operation is effected, the shoals that haunt our coast disappear: but individuals are to be found and many are caught throughout the year. So far are they from being migratory to us from the North only, that Herrings visit the west coast of the county of Cork in August, which is earlier than those which come down the Irish Channel arrive, and long before they make their appearance at other places much farther north. "In former times, the fishery of the east coast did not commence till that on the west had terminated. It is remarkable also that the eastern fishery has become so abundant as quite to have obscured the western." And Dr. M'Culloch, from other examples, confirms a statement previously made, that the fishery has commenced soonest on the southern part of the shore; and, what is also remarkable, that for some years past it has become later every year.

The Herring is in truth a most capricious fish, seldom remaining long in one place; and there is scarcely a fishing station round the British Islands that has not experienced in the visits of this fish the greatest variations both as to time and quantity, without any accountable reason.

"Ordinary philosophy is never satisfied," adds Dr. M'Culloch, "unless it can find a solution for everything;

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* See an excellent paper on the Herring in the 32nd number of the Journal of the Royal Institution, for January 1824.

and is satisfied, for this reason, with imaginary ones. Thus, in Long Island, one of the Hebrides, it was asserted that the fish had been driven away by the manufactory of kelp; some imaginary coincidence having been found between their disappearance and the establishment of that business. But the kelp fires did not drive them away from other shores, which they frequent and abandon indifferently without regard to this work. It has been a still more favourite and popular fancy, that they were driven away by the firing of guns; and hence this is not allowed during the fishing season. A gun has scarcely been fired in the Western Islands, or on the west coast, since the days of Cromwell; yet they have changed their places many times in that interval. In a similar manner, and with equal truth, it was said that they had been driven from the Baltic by the battle of Copenhagen. It is amusing to see how old theories are revived. This is a very ancient Highland hypothesis, with the necessary modification. Before the days of guns and gunpowder, the Highlanders held that they quitted coasts where blood had been shed: and thus ancient philosophy is renovated. Steam-boats are now supposed to be the culprits, since a reason must be found: to prove their effect, Loch Fyne, visited by a steam-boat daily, is now their favourite haunt, and they have deserted other lochs where steam-boats have never yet smoked." A Member of the House of Commons, during the sessions of 1835, in a debate on a tithe bill, stated, that a clergyman having obtained a living on the coast of Ireland, signified his intention of taking the tithe of fish; which was, however, considered to be so utterly repugnant to their privileges and feelings, that not a single Herring had ever since visited that part of the shore!

Our common Herring spawns towards the end of October or the beginning of November; and it is for two or three months previous to this, when they assemble in immense numbers, that the fishing is carried on, which is of such great and national importance. "And here," Mr. Couch observes, "we cannot but admire the economy of Divine Providence, by which this and several other species of fish are brought to the shores, within reach of man, at the time when they are in their highest perfection, and best fitted to be his food."

The mode of fishing for Herrings is by drift-nets, very similar to those employed for taking Mackerel and Pilchard, with a slight difference in the size of the mesh. The net is suspended by its upper edge from the drift-rope by various shorter and smaller ropes, called buoy-ropes; and considerable practical skill is required in the arrangement, that the net may hang with the meshes square, smooth, and even, in the water, and at the proper depth; for, according to the wind, tide, situation of their food, and other causes, the Herrings swim at various distances below the surface.

The size of the boat used depends on the distance from shore at which the fishery is carried on; but, whether in deep or in shallow water, the nets are only in actual use during the night. It is found that the fish strike the nets in much greater numbers when it is dark than while it is light: the darkest nights, therefore, and those in which the surface of the water is ruffled by a breeze, are considered the most favourable. It is supposed that nets stretched in the daytime alarm the fish, and cause them to quit the places where that practice is followed; it is therefore strictly forbidden.

A visit to the Herring-fishers on the west coast of Ireland is thus described by the author of "Wild Sports in the West."—"Having lighted our pipes, and procured our boat-cloaks, we left the pier-head in the four-oared galley. The night was unusually dark and warm; not a breath of wind was on the water; the noise of the oars, springing in the coppered rullocks, was heard for a mile off, and the whistle of sandpipers and curlews, as they took wing from the beach we skirted, appeared unusually shrill. Other noises gradually broke the stillness of the night. The varied hum of numerous voices chanting the melancholy songs which are the especial favourites of the Irish, began to be heard distinctly, and we soon bore down upon the midnight fishers, directed by sound, not sight.

“ To approach the fleet was a task of some difficulty. The nets, extended in interminable lines, were so frequent, that much skill was necessary to penetrate this hempen labyrinth, without fouling the back ropes. Warning cries directed our course, and with some delay we threaded the crowded surface, and guided by buoys found ourselves in the very centre of the flotilla.

“ It was an interesting scene. Momently the boats glided along the back ropes, which were supported at short intervals by corks, and at a greater by inflated dog-skins, and, raising the curtain of net-work which these suspended, the Herrings were removed from the meshes, and deposited in the boats. Some of the nets were particularly fortunate, obliging their proprietors to frequently relieve them of the fish; while others, though apparently stretched within a few yards, and consequently in the immediate run of the Herrings, were favoured but with a few stragglers; and the unemployed fisherman had to occupy himself with a sorrowful ditty, or in moody silence watched the dark sea like some dull ghost waiting on Styx for waftage.

“ Our visit appeared highly satisfactory; every boat tossed us Herrings on board, until we were obliged to refuse further largess; and these many ‘ trifles of fish ’ accumulated so rapidly, that we eventually declined receiving other compliments, or we might have loaded the gig gunnel-deep.

“ The darkness of the night increased the scaly brilliancy which the phosphoric properties of these beautiful fish produce. The bottom of the boat, now covered with Herrings, glowed with a living light, which the imagination could not create, and the pencil never imitate. The shades of gold and silvery gems were rich beyond description; and, much as I had heard of phosphoric splendour before, every idea I had formed fell infinitely short of its reality.

"The same care with which we entered disembarrassed us of the midnight fishing; every boat we passed pressed hard to throw in a cast of *skuddawns* (Herrings) for the strange gentleman; and such was the kindness of these hospitable creatures, that, had I been a very Behemoth, I should have this night feasted to satiety on their bounty.

"The wind, which had been asleep, began now to sigh over the surface, and before we had cleared the outer back ropes, the sea-breeze came curling the midnight wave. The tide was flowing fast, and having stepped the mast, we spread our large lug, and the light galley slipped speedily ashore."

In his Prize Essay on the Fishes of the Forth, Dr. Parnell says, "Herrings enter the Frith of Forth about the end of December, or the beginning of January, and remain two or three weeks at the mouth of the estuary before they attempt to ascend. This delay seems greatly to depend on the state of the weather; for in some seasons, when it is mild and fine, they have been observed to swarm in the Frith off Musselburgh in the early part of January; whilst, in the rough and stormy seasons, they do not make their appearance on that part of the coast before the middle of February; and always disappear before the end of March. They seem to visit the Frith regularly every winter; and a season very seldom passes without a few being captured, and sent to the Edinburgh market. Some years they appear in much larger shoals than in others, the reason of which is not accounted for. In the year 1816, Pilchards were taken in the Frith of Forth in great abundance, when not a dozen Herrings were seen during the whole winter. Since that time, not a single Pilchard has been known to enter the estuary." In June, July, and August, Herrings are taken off the Dunbar and Berwick coasts in considerable number, from whence the Edinburgh market is abundantly supplied, when scarcely a single Herring is to be seen higher in the Frith of a size worth the notice of the fishermen.

The Herring having spawned, retires to deep water, and the fishing ends for that season. While inhabiting the depths of the ocean, its food is said by Dr. Knox to consist principally of minute entomostracous animals ; but it is certainly less choice in its selection when near the shore. Dr. Neill found five young Herrings in the stomach of a large female Herring ; he has also known them to be taken by the fishermen on their lines, the hooks of which were baited with limpets ; and they have been repeatedly caught by anglers with an artificial fly. They are known to feed upon minute crustacea, small medusæ, and the spawn and fry of fishes. The Rev. Robert Holdsworth wrote me word that in January 1823, he took a small Bass three inches long from the stomach of a Herring, caught at Kingswear, in the river Dart. The young abound in the shallow water all round our shores during the summer months. I have seen them taken off Brighton in the small-meshed nets which are there used to draw for Atherine ; and they are caught by boys while angling from piers and rocks at various places along the southern coast. They are very abundant on the Yorkshire coast, where they are called Herring-sile ; and they swarm among the Orkney and Shetland Islands during the whole of the summer. They remain at the mouth of the Thames during their first autumn and winter : many are caught on the coasts of Essex and Kent in the nets used for taking Sprats. From repeated examinations, I am induced to believe these young fish do not mature any roe during their first year. A few are occasionally caught by the net in Dagenham Breach, seldom exceeding eight or nine inches in length, and are remarkably mild in flavour.

The length of the head compared to the length of the body alone, without the head or caudal rays, is as one to four; the depth of the body compared to the whole length of the fish, as one to five; the commencement of the dorsal fin half-way between the point of the upper jaw and the end of the fleshy portion of the tail: the longest ray nearly as long as the base of the fin: the pectoral fin rather large compared to the size of the other fins. The ventral fin arises considerably behind the line of the commencement of the dorsal fin: this fin is small, with elongated axillary scales; its origin half-way between the point of the lower jaw and the end of the short central caudal rays. The anal fin begins half-way between the origin of the ventral and the end of the fleshy portion of the tail, and extends over half the distance between its origin and the end of the fleshy portion, thus occupying the third quarter division of the distance between the origin of the ventral fin and the end of the fleshy portion of the tail; the rays very short. The tail considerably forked; the outer rays as long again as those of the middle. The fin-rays in number are—

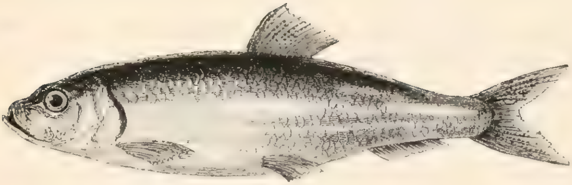
D. 17 : P. 15 : V. 9 : A. 14 : C. 20. Vertebræ 56;

varying in some specimens to

D. 19 : P. 17 : V. 9 : A. 16 : C. 18.

The lower jaw is by much the longer, with five or six small teeth extending in a line backwards on each side from the anterior point; four rows of small teeth on the central upper surface of the tongue; a few small teeth on the central portion of the upper jaw, and the inferior edges below the gape finely serrated: the eye large; its diameter compared to the length of the head as two to seven, and placed at the distance of its own breadth from the end of the nose: the dorsal and abdominal lines of the body slightly convex; the belly carinated, but not serrated; the scales moderate in size, oval, and thin. The upper part of the fish a fine blue, with green and other reflections when viewed in different lights; the lower part of the side and belly silvery white; cheeks and gill-covers silvery, exhibiting the appearance of extravasation when the fish has been dead twenty-four hours. Dorsal and caudal fins dusky; the fins on the lower parts of the body almost white.

ABDOMINAL
MALACOPTERYGII. *CLUPEIDÆ.*



LEACH'S HERRING.

Clupea Leachii, Yarrell, Zoological Journal, vol. v. p. 277, pl. 12.
,, ,, *Leach's Herring,* Jenyns, Brit. Vert. p. 434.

The examination of considerable quantities of the various sorts of fish caught at the mouth of the Thames during winter by fishermen engaged in taking Sprats, has enabled me to select what I believe to be a second species of British Herring.

The common Herring, when it visits our coast in autumn, is taken heavy with roe, which it deposits towards the end of October. It is certain that the fishing for them is abandoned about that time, as no purchasers could be found for the "shotten Herring;" and it is also well known that the Herrings, having cast their roe, retire from the shore to deep water. Numbers of the young of the common Herring are taken with the Sprats. These are called Yawlings by some fishermen,—a term probably derived from yearling. But these young Herrings differ materially from the Herring which I believe to be new. The yearling fish have the elongated form of the adult common Herring: if seven inches long, which is about their average length, they are only one inch and three-eighths in depth, and are without roe. Having examined them repeatedly during the winter months, I am induced to believe they do not mature any roe during their first year; and the fact of their remaining in large shoals at the mouth of the Thames after the Herrings that have recently spawned have left the shore, may be taken in corroboration; for had they matured and deposited any roe, they would, like the more adult fish of their own species, have experienced the same necessity for retiring to deep water.

The Herring, however, which I now refer to, is found heavy with roe at the end of January, which it does not deposit till the middle of February. Its length is not more than seven inches and a half, and its depth near two inches. It is known that Dr. Leach had often stated that our coast produced a second species of Herring; but I am not aware that any notice of it has ever appeared in print. In order, however, to identify the name of that distinguished naturalist with a fish of which he was probably the first observer, I proposed for it the name of *Clupea Leachii.*

Dr. Leach's observations on the Herring were made during his visit to the extended line of our southern coast in the year 1808; and Mr. Jesse, in his "Gleanings in Natural History," has noticed the superiority and consequent partiality that is said to exist in favour of the Herrings of Cardigan Bay over those that are taken at Swansea.

Of the existence of a second species of Herring on our shores further proof may be adduced in the following extracts.

"In former times," says Dr. M'Culloch, "the fishery of the east coast of Scotland did not commence till that on the west had terminated. It was then supposed, and not very unreasonably, that the fish had changed their ground, and that these were the western Herrings. Yet it ought to have been plain that this was not the case, as the eastern fish were entirely different in quality from the western, and very inferior. At the same time, they were in that condition as to spawning which proved that they could not have been the same fish. The fact of their being entirely different fish is now at least fully proved, because on both shores the period of the fishery has been the same."—*Journal of the Royal Institution, No.* 32, *for January*, 1824, *p.* 217.

"A smaller but superior species of Herring is found occasionally in Loch Eriboll; but it is chiefly used for home consumption."—*Scotch Statistics, Durness.*

There are three species of Herring said to visit the Baltic, and three seasons of roe and spawning. The Strömling, or small Spring Herring, spawns when the ice begins to melt; then a larger Summer Herring; and lastly, towards the middle of September, the Autumn Herring makes its appearance, and deposits its spawn.

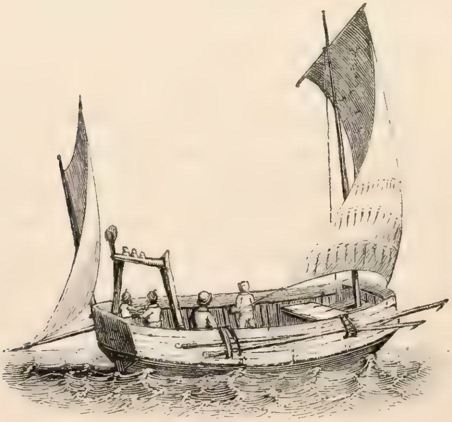
The length of the head compared to that of the body alone, without the head or caudal rays, is as one to three; the depth of the body greater than the length of the head, and compared to the length of the head and body together is as one to three and a half; it is therefore much deeper in proportion to its length than our common Herring, and has both the dorsal and abdominal lines much more convex: the under jaw longer than the upper, and provided with three or four prominent teeth just within the angle formed by the symphysis; the superior maxillary bones have their edges slightly crenated: the eye is large, in breadth full one-fourth of the length of the whole head; irides pale yellow: the dorsal fin is placed behind the centre of gravity, but not so much so as in the common Herring;

the scales are smaller; the sides without any distinct lateral line: the edge of the belly carinated, but not serrated; the fins small. The fin-rays in number are—

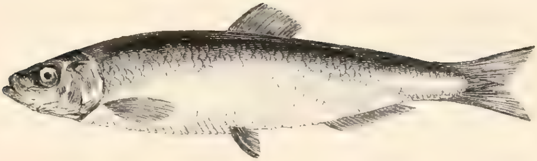
D. 18 : P. 17 : V. 9 : A. 16 : C. 20. Vertebræ 54.

The back and upper part of the sides are deep blue, with green reflections, passing into silvery white beneath. The flesh of this species differs from that of the common Herring in flavour, and is much more mild.

Intending to make the fishing-boats of several countries the subjects of some of the vignettes, that at page 192, represents a Dutch boat: the vignette below is a representation of a French fishing-boat.



ABDOMINAL
MALACOPTERYGII. *CLUPEIDÆ.*



THE SPRAT.

GARVIE HERRING AND GARVIE. *Scotland.*

Clupea sprattus, Linnæus. Bloch, pt. i. pl. 29, fig. 2.
,, ,, Cuvier, Règne An. t. ii. p. 318.
,, ,, *Sprat*, Penn. Brit. Zool. vol. iii. p. 457.
,, ,, ,, Jenyns, Brit. Vert. p. 435.

Willughby and Ray, deceived apparently by the misapplication of the name by the fishermen of Cornwall, with which the latter became acquainted during his journey in that country, considered that the word Sprat was only a name for the young of the Herring and of the Pilchard, and others have been misled by their authority: but so well is this fish distinguished from both by the strongly serrated edge of the abdomen, that there is not a fisherman round those parts of our coast where the Sprat is taken that cannot immediately distinguish it from either, even in the midst of the darkest night. Its characters being now sufficiently appreciated, it is by some, and ought to be by all, admitted as a good and distinct species.

Though a much less valuable fish than the Herring, it is still a very useful one. Coming into the market in immense quantities and at a very moderate price immediately after the Herring season is over, it supplies during all the winter months of the year a cheap and agreeable food. Large quantities are eaten; and, from their rich quality and flavour, the consumption is not solely confined to the lower classes. They are generally cooked while fresh, but are also preserved in various ways.

The Sprat is included by Linnæus in his *Fauna Suecica*, and by Professors Nilsson and Reinhardt in their publications on the Fishes of Scandinavia. Dr. Neill says the Sprat is sold in Edinburgh market by the dozen; and I have received specimens that were taken in the Forth, where they are called Garvie Herrings and Garvies. Dr. George Johnston, in his list of the Fishes of Berwickshire, says the Sprat is common there, and is a favourite food of the Salmon tribe. Farther south, they are most plentiful on the Norfolk, Suffolk, Essex, and Kentish coasts. I have taken them on the Dorsetshire coast in June, and they were then in roe. They inhabit the deep water round our southern coast during the summer months, and may be found in the stomachs of many of our voracious fishes every month in the year. I have taken three Sprats from the stomach of a Whiting, and have caught young Sprats off Ramsgate, Hastings, and Weymouth, in the months of August and September. Like the other species of the genus *Clupea*, they are wanderers: the shoals are capricious in their movements, and exceedingly variable in their numbers. "Upwards of a ton weight of Sprats was sold in our market last Saturday." —(*Taunton Courier*, January 1832.) "It is nearly fifty years since this useful fish visited the neighbouring coast, and they now appear in exhaustless shoals close in shore on the south coast of Devon."

The Sprat is occasionally taken in Cornwall; and in Ireland, on the coasts of Cork, Dublin, and Belfast.

In Cornwall the true Sprat is, however, very rare; and the name is appropriated, as it was by the old fishermen whom Ray consulted one hundred and fifty-six years ago, to the fry of the Herring and of the Pilchard. An analogous misapplication of a name exists on the eastern coast, where the true Pilchard rarely occurs, and where the name of Pilchard is given to the fry of the Shad and the half-grown Herring.

The fishing season begins early in November, continuing through the winter months; and the largest quantities are taken when the nights are dark and foggy. A few, and those of the best description, are taken in the same manner as the Mackerel, the Pilchard, and the Herring, by drift-nets of fine twine and suitable small mesh; a mode of fishing peculiarly adapted for the capture of those species which rove in shoals through the water. But the most destructive plan pursued against Sprats is by a mode called stow-boat fishing. The stow-boat net goes with two horizontal beams: the lower one, twenty-two feet long, is suspended a fathom above the ground; the upper one, a foot shorter in length, is suspended about six fathoms above the lower one. To these two beams, or balks, as they are called, a large bag-net is fixed, towards the end of which, called the hose, the mesh is fine enough to stop very small fry. The mouth of the net, twenty-two feet wide and thirty-six feet high, is kept square by hanging it to a cable and heavy anchor at the four ends of the beams. The net is set under the boat's bottom; and a rope from each end of the upper beam, brought up over each bow of the boat, raises and sustains the beam, and keeps the mouth of the net always open, and so moored that the tide carries everything into it. A strong rope, which runs through an iron ring at the middle of the upper beam, and is made fast to the middle of the lower beam, brings both beams together parallel, thus closing the mouth of the net when it is required to be raised. In this way an enormous quantity of Sprats, with the fry of many other species, are taken, which are principally sold by measure to manure land near the coast.

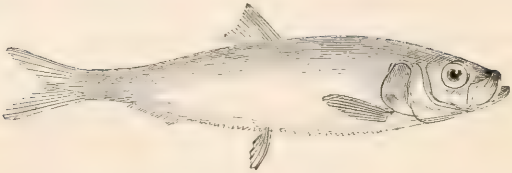
From four to five hundred boats are thus employed during the winter. Many thousand tons in some seasons are taken and sold at sixpence and eight-pence the bushel, depending on the supply and demand, to farmers, who distribute about forty bushels of Sprats over an acre of land, and sometimes manure twenty acres at the cost of twenty shillings an acre. In the winter of 1829-30, Sprats were particularly abundant: barge-loads, containing from one thousand to fifteen hundred bushels, bought at sixpence a bushel, were sent up the Medway as far as Maidstone to manure the hop-grounds. The coasts of Kent, Essex, and Suffolk are the most productive. So great is the supply thence obtained, that notwithstanding the immense quantity consumed by the million and a half inhabitants of London and its neighbourhood, there is yet occasionally a surplus to be disposed of at so low a price as to induce the farmers even so near the metropolis as Dartford to use them for manure.

A full-sized Sprat measures six inches in length, and rather more than one inch and one-eighth in depth. The length of the head compared to that of the body alone is as one to four; compared to the whole length of the fish, as one to six: the depth of the body is to the whole length as one to five. The dorsal fin commences exactly half-way between the point of the lower jaw and the end of the caudal rays: the ventral fins arise in a vertical line under the first dorsal fin-ray, and have no axillary scales; the ventral fins in the Pilchard and Herrings begin under the middle of the dorsal fin, and both have axillary scales,—these are two other external distinctions: the under jaw is the longest; the diameter of the eye less than one-fourth of the whole head: considerable convexity of the dorsal and abdominal lines; the latter serrated before the ventral fins, and still more strongly so behind them: the tail deeply forked; the scales large, round, and deciduous; the upper part of the head and back dark blue, with green reflections passing into silvery white on the gill-covers, sides, and belly; the dorsal and caudal fins dusky; pectoral, ventral, and anal fins white. The fin-rays in number are—

D. 17 : P. 15 : V. 7 : A. 18 : C. 19. Vertebræ 48.

By the kindness of Mr. Loudon, I have received some small fish which came from Riga, where they are called Kilkies, and are eaten as a whet before dinner. They proved to be our Sprat. At Reval, and other places in the gulf of Finland, young Herrings (Strömling), when about the size of Sprats, are prepared with spices, and sent to Petersburgh, London, and other places, for the use of the table. These are also in some estimation as a relish for lunch, from their peculiar flavour, and are sold in small jars, labelled *Kilo Strömelein.*

ABDOMINAL
MALACOPTERYGII. *CLUPEIDÆ.*



THE WHITEBAIT.

Clupea alba, Yarrell, Zool. Journ. vol. iv. p. 137 and 465, pl. 10.
,, ,, *Whitebait*, Penn. Brit. Zool. vol. iii. p. 465, pl. 80.
,, *alosa*, *Young Shad*, Don. Brit. Fish. pl. 98.
,, *alba*, *Whitebait*, Jenyns, Brit. Vert. p. 436.

In the papers on the subject of the Whitebait published in the fourth volume of the Zoological Journal, I endeavoured to prove, historically and anatomically, that this little fish was not, as had been supposed, the young of the Shad, but a distinct species. In its habits it differs materially from all the other British species of *Clupea* that visit our shores or our rivers. From the beginning of April to the end of September this fish may be caught in the Thames as high up as Woolwich or Blackwall, every flood-tide, in considerable quantity, by a particular mode of fishing to be hereafter described. During the first three months of this period, neither species of the genus *Clupea*, of any age or size, except occasionally a young Sprat, can be found and taken in the same situation by the same means. The young Shad of the year are not two inches and a half long till

November, when the Whitebait season is over; and these young Shad are never without a portion of that spotted appearance behind the edge of the upper part of the operculum, which in one species particularly is so marked a peculiarity in the adult fish. The Whitebait, on the contrary, never exhibits a spot on the side at any age; but from two inches long up to six inches, which is the length of the largest I have seen, the colour of the sides is uniformly white.

About the end of March or early in April, Whitebait begin to make their appearance in the Thames, and are then small, apparently but just changed from the albuminous state of very young fry.* During the fine weather of June, July, and August, immense quantities are consumed by visiters to the different taverns at Greenwich and Blackwall. Pennant says, " They are esteemed very delicious when fried with fine flour, and occasion during the season a vast resort of the lower order of epicures to the taverns contiguous to the places where they are taken." What might have been the particular grade of persons who were in the habit of visiting Greenwich to eat Whitebait in the days when Pennant wrote, I am unable to state; but at present, the fashion of enjoying the excellent course of fish as served up either at Greenwich or Blackwall is sanctioned by the highest authorities, from the court at St. James's Palace in the West, to the Lord Mayor and his court in the East, including the Cabinet Ministers† and the philosophers of the Royal Society. As might be expected, examples so numerous and influential have corresponding weight; and accordingly there are few entertainments more popular or more agreeable than a Whitebait dinner.

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* The Shad do not deposit their spawn till the end of June or the beginning of July.

† In the Morning Post of the day on which this account of the Whitebait was written, September 10th, 1835, the following paragraph appeared:—

" Yesterday the Cabinet Ministers went down the river in the Ordnance barges to Lovegrove's West India Dock Tavern, Blackwall, to partake of their annual fish dinner. Covers were laid for thirty-five gentlemen."

The fishery is continued frequently as late as September; and specimens of young fish of the year, four and five inches long, are then not uncommon, but mixed, even at this late period of the season, with others of very small size, as though the roe had continued to be deposited throughout the summer; yet the parent fish are not caught, and are believed by the fishermen not to come higher up than the estuary, where, at this season of the year, nets sufficiently small in the mesh to stop them are not in much use.

The particular mode of fishing for Whitebait, by which a constant supply during the season is obtained, was formerly considered destructive to the fry of fishes generally, and great pains were taken to prevent it by those to whom the conservancy of the fishery of the Thames was entrusted; but since the history and habits of this species have been better understood, and it has been ascertained that no other fry of any value swim with them,—which I can aver,—the men have been allowed to continue this part of their occupation with little or no disturbance, though still using an unlawful net.

When investigating the subject of the Whitebait, I was occasionally engaged in witnessing the mode by which such numbers were taken. The mouth of the net is by no means large, measuring only about three feet square in extent; but the mesh of the hose, or bag-end of the net, is very small. The boat is moored in the tide-way, where the water is from twenty to thirty feet deep; and the net with its wooden frame-work is fixed to the side of the boat, as shown in the vignette at page 207. The tail of the hose, swimming loose, is from time to time handed into the boat, the end untied, and its contents shaken out. The wooden frame forming the mouth of the net does not dip more than four feet below the surface of the water; and, except an occasional straggling fish, the only small fry taken with the Whitebait are the various species of Sticklebacks, and the very common Spotted or Freckled Goby, described in vol. i. page 288; neither of which are of sufficient value or importance to require protection.* The farther the fishermen go down towards the mouth of the river, the sooner they begin to catch Whitebait after the flood-tide has commenced. When fishing as high as Woolwich, the tide must have flowed from three to four hours, and the water become sensibly brackish to the taste, before the Whitebait will be found to make their appearance. They return down the river with the first of the ebb-tide; and various attempts to preserve them in well-boats in pure fresh water have uniformly failed.

The Hamble, which runs into the Southampton Water, is the only other southern river from which I have received Whitebait. But this I believe to be owing rather to the want of a particular mode of fishing by which so small a fish can be taken so near the surface, than to the absence of the fish itself; which, abounding as it does in the Thames, I have very little doubt might be caught in some of the neighbouring rivers on our south and east coasts. In the vicinity of the Isle of Wight, Whitebait, from their brilliancy and consequent attraction, are used by the fishermen as bait on their lines when fishing for Whitings.

The Thames fishermen who live at and below Gravesend know the Whitebait perfectly, and catch them occasionally of considerable size in the small-meshed nets used in the Upper and Lower Hope for taking shrimps, called trinkernets, which are like Whitebait nets, only larger; but these nets, working near the bottom, principally arrest the fry of the ground-swimming fishes.

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* The fifteenth printed rule and order of the Lord Mayor and his court is, that "no person shall take at any time of the year any sort of fish usually called Whitebait, upon pain to forfeit and pay five pounds for every such offence; it appearing to this court that under pretence of taking Whitebait the small fry of various species of fish are destroyed."—Page 11.

The Sprat-fishers take the adult Whitebait frequently on the Kentish and Essex coasts throughout the winter.

Dr. Parnell, in his History of the Fishes of the Forth, says, "The Whitebait is not, as it was formerly considered to be, peculiar to the Thames, as I have found it to inhabit the Frith of Forth in considerable numbers during the summer months. From the beginning of July to the end of September they are found in great abundance in the neighbourhood of Queensferry, and opposite Hopetown House, where I captured, in one dip of a small net of about a foot and a half square, between two and three hundred fish, the greater part of which were Whitebait of small size, not more than two inches in length; the remainder were Sprats, young Herrings, and fry of other fishes.

"In their habits they appear to be similar to the young of the Herring, always keeping in shoals, and swimming occasionally near the surface of the water, where they often fall a prey to aquatic birds."

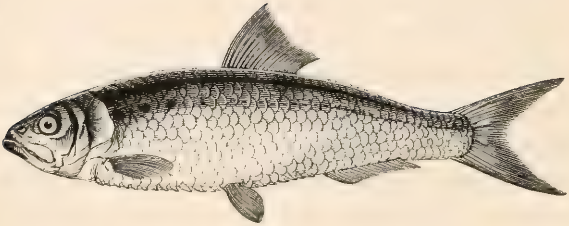
The length of the head compared with that of the body alone is as two to five; the depth of the body compared to the whole length of the fish, as one to five: the dorsal fin commences half-way between the point of the closed jaws and the ends of the short middle caudal rays; the longest ray of the dorsal fin as long as the base of the fin; the ventral fin arises behind the line of the commencement of the dorsal, and half-way between the point of the closed jaws and the end of the longest caudal rays; the tail long and deeply forked. The fin-rays in number are—

D. 17 : P. 15 : V. 9 : A. 15 : C. 20. Vertebræ 56.

The head is elongated; the dorsal line less convex than that of the abdomen; the scales deciduous; the abdominal line strongly serrated from the pectoral fin to the anal aperture.

The lower jaw the longest, and smooth; the upper slightly crenated: the tongue with an elevated central ridge without teeth: the eye large; the irides silvery: the upper part of the back pale greenish ash; all the lower part, the cheeks, gill-covers, sides, and belly, silvery white: dorsal and caudal fins coloured like the back; the latter tipped with dusky: pectoral, ventral, and anal fins, white. The only food I could find in the stomach were the remains of minute crustacea.

ABDOMINAL MALACOPTERYGII. *CLUPEIDÆ.*



THE TWAITE SHAD.

Alosa finta, Cuvier, Règne An. t. ii. p. 320.
,, ,, Willughby, pl. P. 3, fig. 1.
,, ,, *La Feinte*, Duhamel, sect. iii. pl. 1, fig. 5.
Clupea alosa, Linnæus. Bloch, pt. i. pl. 30.
,, ,, *Shad*, Penn. Brit. Zool. vol. iii. p. 460, pl. 80.
,, ,, ,, Don. Brit. Fish. pl. 57.
,, ,, ,, Flem. Brit. An. p. 183, sp. 53.
,, ,, ,, Jenyns, Brit. Vert. p. 437.

Alosa. *Generic Characters.*—Upper jaw with a deep notch in the centre; in other respects like *Clupea.*

Baron Cuvier, in the last edition of the *Règne Animal*, has advanced the Shads, of which we have two species, to the rank of a genus, on account of the deep central notch in the upper lip; and I have followed this example for the additional reason that it will the more easily and effectually afford the means of obtaining a desirable alteration in our nomenclature.

According to Cuvier, most modern authors have misapplied the systematic trivial names of these two species, calling the Shad with teeth, and several spots along each side, *C. alosa*; and the larger Shad without teeth, and with a single spot only behind each gill-cover, or none at all, *C. finta*.

The *Alosa* of Rondeletius is not described or figured as possessing either teeth or spots; and Cuvier, by his usual research, had probably satisfied himself that the fish to which the term *alosa* had been originally applied was a toothless Shad, and that the toothed and spotted Shad was the true *finta*. Pennant, in noticing the second British species of Shad taken in the Thames and the Severn, which is without teeth or the row of lateral spots, called it an Allis; a name which it would be desirable still to retain, in reference to the generic term *Alosa*. The old name for the Shads was *Lachia*; and hence are derived *Hallachia*, *Alachia*, *Alosa*, *Alose*, and Allis or Allice.

The differences noticed by Pennant and others in the smaller species of Shad, taken also in the Severn, near Gloucester, called the Twaite, induces the belief that it is our common Thames Shad; and the note by the editor of the last edition of the British Zoology, at the foot of page 463, (vol. iii.) is particularly deserving of notice. "I suspect," says the note, "that the Shad and Twaite are distinct species, and correspond with the *Alose* and *Feinte* of Duhamel." This appears to be precisely the case, as a comparison of our two Shads with the representations in Duhamel's work will prove: and Professor Nilsson, in his Prodromus of the Fishes of Scandinavia, which has been frequently referred to, has correctly designated and described our more common Shad of the Thames as the *finta** of Cuvier.

I venture to propose the names of Twaite Shad and Allice Shad for our two species, the better in future to distinguish them; thus combining the generic name Shad with a trivial name by which these two fishes have been hitherto, to some extent at least, locally known.

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* Page 22.—*C. finta* Cuv. *C. maxilla superiore antice profunde incisa; inferiore vix longiore; maculis* 5 — 6 *lateralibus in serie positis; dentibus utriusque maxillæ distinctis. Longit. circa* 15 *poll.*

The Twaite Shad then, if I may so call it, is a sea-fish which enters our rivers about May, and in consequence of the time of its annual visit to some of the rivers of the European Continent is called the May-fish. The object of its visit to the fresh water is to deposit its spawn; and, that accomplished, it returns to sea by the end of July. Twaite Shads appear during these three months in abundance in the Thames, from the first point of land below Greenwich, opposite the Isle of Dogs, to the distance of a mile below; and great numbers are taken every season. These fish produce, however, but a small price to the fishermen, being in little repute as food, their muscles being exceedingly full of bones and dry. Formerly great quantities of the Twaite Shad were caught with nets in that part of the Thames opposite the present Penitentiary at Millbank, Westminster. Above Putney Bridge was another favourite spot for them; but the state of the water, it is believed, prevents the fish ascending the river in the same manner as in former years, and but few comparatively are taken. The ordinary size of the adult fish of this species is from twelve to sixteen inches.

Shad are not allowed to be caught in the Thames after the 30th of June, that the remaining fish may cast their spawn without interruption from nets.*

The principal spawning-time of the Twaite Shad in the Thames is about the second week in July, when numbers may be seen and heard frisking at or near the surface. In the language of fishermen, the Shad are said to thrash the water with their tails: they appear to disencumber themselves of the matured roe by violent muscular action; and on a calm still evening or night the noise they make may be heard at some distance. I have obtained the young only two inches and a half long in October; and suspect they grow slowly, finding them only four inches long, and the young of the larger Allice Shad only six inches long, in the following spring.

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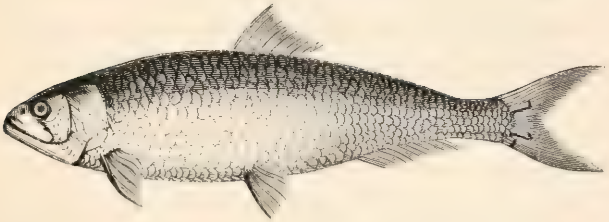
* Whitebait are plentiful throughout May and June.

The habits and habitat of the two species of Shads have probably been very frequently confounded. Though both are common in the Severn during a particular season, Montagu has not noticed the appearance of either on the coast of Devon: yet the Rev. Mr. Holdsworth sends me word that Twaite Shad are very common on that coast and in the rivers; he has taken several at one time when whiffing with a light running line for Mackerel in the mouth of the Dart. The bait was a slice of a Mackerel. Both species have been noticed on the Cornish coast by Mr. Couch, and one has been taken near Dublin. I learn from Mr. Heysham that both species have been taken on the west coast of Cumberland. On the eastern coast it is common in the Thames; is occasionally taken off Yarmouth, on the Norfolk coast, with the Herrings, and also in the Tyne. Dr. Parnell says, "On the coast of Scotland, the Twaite Shad receives the name of Rock Herring. We observe this fish enter the Frith of Forth in tolerable abundance towards the end of July, and dozens are then taken in the Salmon-nets, at almost every tide; but after August we lose sight of them until the following season. It appears to have a considerable range to the northward, both Professors Nilsson and Reinhardt including it among the fishes of Scandinavia. The food of the Shads is small fish and the softer-skinned crustacea.

The length of the head compared to the whole length of the fish is as one to five; the depth of the body rather greater than the length of the head; the distance from the point of the nose to the commencement of the dorsal fin, measured again from thence backwards, falls far short of the end of the fleshy portion of the tail; the base of the last dorsal fin-ray is half-way between the point of the nose and the end of the caudal rays; the longest ray of the dorsal fin is as long as the base of the fin; the ventral fins, without axillary scales, are placed a little behind the line of the commencement of the dorsal fin; the base of the anal fin, occupying about two-fifths of the space between the ventral fin and the end of the fleshy portion of the tail, is shorter than the anal fin in the Allice Shad, and has five rays less, beginning also more forward: the tail deeply forked; the caudal rays with two thin membranous appendages on each side, parallel to the seventh and thirteenth caudal rays, about an inch in length by three-eighths deep; all four membranes opening from the centre, being attached by the outer edge only. The scales of the body rather larger in proportion than those of the Allice; the lateral line, as in most of the *Clupeidæ*, scarcely perceptible. The abdomen strongly serrated. The lower jaw the longest, with a few teeth anteriorly; the upper jaw with a deep central notch, and a row of small teeth on the edge down each side. The breadth of the eye equal to one-fourth of the length of the head; the mucous vessels on the surface of the gill-covers beautifully arborescent; the top of the head and back dusky blue, with brown and green reflections in particular points of view; from the upper edge of the operculum a row of five or six dark spots extend in a line backwards, the last generally the most indistinct, the number sometimes more than six; the irides, sides of the head and body, silvery white, with a tinge of copper colour; dorsal and caudal fins dusky; pectoral, ventral, and anal fins white. This species is immediately distinguished from the Allice Shad by possessing teeth, the lateral spots, and the smaller anal fin. The fin-rays in number are—

D. 18 : P. 15 : V. 9 : A. 21 : C. 19. Vertebræ 55.

ABDOMINAL
MALACOPTERYGII. *CLUPEIDÆ.*



THE ALLICE SHAD.

Alosa communis,	Cuvier, Règne An. t. ii. p. 319.
,, ,,	Willughby, pl. P. 3, fig. 2.
,, ,,	*Allice,* Penn. Brit. Zool. vol. iii. p. 463.
,, ,,	*Alose,* Duhamel, sect. iii. pl. 1, fig. 1.
Clupea alosa,	*Allis,* Jenyns, Brit. Vert. p. 439.

The Allice Shad, by far the larger of the two in size, appears to be much more limited in its localities as a British species. It is represented by Pennant and others as abundant in the Severn, but is much less known elsewhere.

Dr. Hastings, in his Illustrations of the Natural History of Worcestershire, at page 77 says, " This is another fish which the Severn affords in great perfection. These fish generally appear in May, though sometimes in April. This, however, depends a good deal upon the quality of the water: if it is clear, they ascend early in the spring; but if there happens to be a flood, they wait till the waters are restored to their former purity; and if they meet with a flood in their progress upward, they immediately return, and keep below Gloucester. The weight of this Shad (the Allice of Pennant) is seldom less than four pounds; they continue in the river about two months, and are succeeded by a variety called the Twaite, which is less than the Shad, never weighing more than two pounds, and is but little esteemed. Dr. Fleming says, that the celebrated Whitebait of the Thames, which appears near Blackwall and Greenwich during the month of July, is the fry of this fish; but as, although the Shad are plentiful in the Severn, we hear nothing of the Whitebait,* further investigation seems to be required on this point."

In the Thames, the Allice Shad is of rare occurrence. A specimen was brought to me in 1831, that had been caught above Putney Bridge; and another was taken in 1833, which is noticed by Mr. Jesse in the third series of his Gleanings in Natural History, page 147. "This fish was taken June 25th, opposite Hampton Court Palace; and its appearance so high up the river is very unusual. On taking it out of the well of the boat, it was full of spawn, and died immediately." I have had opportunities of examining very fine specimens from the Severn, sent to me by T. B. L. Baker, Esq. of Hardwick Court.

This species is not uncommon on the north-east coast of Ireland. On the north-eastern coast of England,—namely, at Berwick,—Dr. George Johnston says it is frequently taken at the mouth of the Tweed in autumn, and sold in the market, but held in no estimation. Dr. Parnell says this species is rare in the Forth.

The flesh of this fish is said to be of good flavour, and the quality is considered to improve the higher the fish ascends the river. Ælian says the Shads appear to take pleasure in the sounds of musical instruments; but if it happens to thunder when they are ascending rivers, they return rapidly to the sea.

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* This, it may be remembered, was adduced as one of the proofs that the Whitebait were not the young of the Shad.

Both species of Shads have great resemblance, except in size, to Herrings, and have been frequently called the mother of Herrings, and king and queen of the Herrings. The large Herrings of two feet in length, so called by Anderson and others, and said to occur in the Northern Seas, and among our Northern Islands, are no doubt to be considered as referring to our Shads.

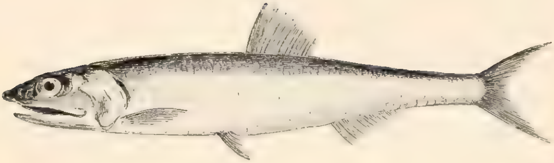
The specimen described measured two feet in length; the body deep and compressed; the thickness rather less than one-third of the depth. The length of the head compared to that of the whole fish is as one to six; the depth compared to the whole length, as one to four and a half. The length of the base of the dorsal fin three inches; the fourth ray, which is the longest, is one-third shorter than the whole length of the base of the fin; the first and second rays shorter than the third; these three rays simple, all the others branched: the first ray half-way between the point of the nose and the last ray of the anal fin; the last ray exactly half-way between the point of the nose and the end of the tail. Pectoral fin small; the upper ray the longest, strong, and simple; the others branched: ventral fin also small; the first ray arising in a vertical line under the first ray of the dorsal fin; axillary scales long, narrow, and pointed: anal fin commencing half-way between the ventral fin and the origin of the lower caudal rays, nearly one-fourth longer in the base than the dorsal fin; the first three rays shorter than the fourth, which is the longest, and only one-third the length of the base of the fin: the tail long and slender, deeply forked; the rays of the middle only one-fourth of the length of the longest external rays; the seventh and thirteenth caudal rays furnished with membranous appendages on each side similar to those observed in the Twaite Shad. The fin-rays in number are—

D. 19 : P. 15 : V. 9 : A. 26 : C. 20.

The lower jaw the longest and smooth; the upper jaw with a central notch; the lateral edges crenated: the breadth of the eye rather less than one-fifth of the length of the head, and placed one diameter and a half from the end of the nose: mucous vessels of the gill-covers beautifully distributed; the nape and shoulders rise suddenly; the greatest depth of the body just before the ventral fin; scales of the body rather large, nearly circular, and thin; no distinct lateral line; abdominal edge strongly serrated, particularly behind the ventral fins. The colours very similar to those of the Twaite Shad, with a single dusky patch behind the operculum, sometimes scarcely visible.

Figure 1 of plate III. in Dr. Fleming's Philosophy of Zoology is a representation of the Allice Shad.

ABDOMINAL
MALACOPTERYGII. *CLUPEIDÆ.*



THE ANCHOVY.

Engraulis encrasicolus,	*Anchovy,*	Flem. Brit. An. p. 183, sp. 54.
,, *vulgaris,*		Cuvier, Règne An. t. ii. p. 322.
,, ,,		Willughby, p. 225, P. 2, fig. 2, App. 27.
Clupea encrasicolus,		Linnæus. Bloch, pt. i. pl. 30, fig. 2.
,, ,,	*Anchovy,*	Penn. Brit. Zool. vol. iii. p. 459, pl. 78.
,, ,,	,,	Don. Brit. Fish. pl. 50.
Engraulis encrasicholus,	,,	Jenyns, Brit. Vert. p. 439.

Engraulis. *Generic Characters.*—Distinguished from the Herrings in having the head pointed ; the upper jaw the longest ; the mouth deeply divided ; the opening extending backwards behind the line of the eyes ; the gape and branchial apertures very large ; the ventral fins in advance of the line of the commencement of the dorsal ; the abdomen smooth ; branchiostegous rays 12.

I have followed Dr. Fleming in preserving to the Anchovy the old name by which it was formerly known. It was called *Lycostomus* from the form of its mouth ; and *Encrasicholus Engraulis*, because from its bitterness it was supposed to carry its gall in its head. For this reason the head as well as the entrails are removed when the fish is pickled.

The Anchovy is a common fish in the Mediterranean from Greece to Gibraltar; and was well known to the Greeks and Romans, by whom the liquor prepared from it, called

Garum, was in great estimation. Its eastern range is extended into the Black Sea.

The fishing for them is carried on during the night, and lights are used with the nets.

The Anchovy is common on the coasts of Portugal, Spain, and France; it occurs, I have no doubt, at the Channel Islands, and has been taken on the Hampshire coast.

The Rev. Robert Holdsworth wrote me word that Anchovies had been taken in a Herring seine-net during autumn in the river Dart; and Mr. Couch, in his Cornish Fauna, says that "this fish abounds towards the end of summer, and if attention were paid to the fishery, enough might be caught to supply the consumption of the British islands. Bloch informs us that the fishery in the Mediterranean is carried on from May to July, at which period this fish enters that sea for the purpose of shedding its spawn; and that when this function is performed it returns to the Atlantic. I have not found them upon our coast until the autumnal equinox; and the fishery would be chiefly followed in October and November, when the fish are in fine condition; but some are met with through the winter, and until the month of March." The Anchovy is taken in the Bristol Channel. In the Appendix to Willughby's work, it is mentioned as having been taken on the coast of Wales; Mr. Bicheno has very recently obtained several on the coast of Glamorganshire; and Mr. Dillwyn, in his contributions towards a History of Swansea, says, "the late Charles Collins, Esq. showed me six pounds of Anchovies which he had purchased in Swansea market for a shilling; and I have since ascertained, if a net with proper meshes was used, that in some summers a vast quantity of these fish might be taken in our bay." Pennant obtained it near his own residence at Downing in Flintshire; and it is said to be sold frequently in Liverpool market. It has not, that I am aware, been recognised on the coast of Ireland.

The Anchovy is reported to be at this time an inhabitant of the large piece of water below Blackwall, called Dagenham Breach; and in May 1838 I received one that was caught in the Thames, where, however, this species is so little known, that the specimen referred to was sent to me with a request to know what fish it was.

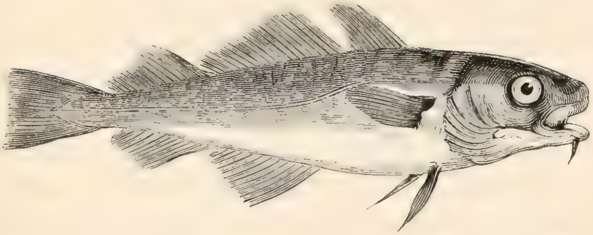
In a series of notes on the occurrence of rare fish at Yarmouth and its vicinity, with which I have been favoured by Dawson Turner, Esq. there is mention of a specimen of the Anchovy, taken on the beach, which measured six inches and a half in length. Mr. Couch says he has seen it in the Cornish seas of the length of seven inches and a half: additional proofs of the large size acquired by this fish on our shores. Dr. George Johnston does not mention this species as occurring on the coast of Berwickshire, nor does Dr. Parnell include it in his Fishes of the Forth: yet its range to the North is extensive, as it is occasionally taken on the coast of Norway and in the Baltic; but is not included by Linnæus in his *Fauna Suecica.*

The Anchovy is immediately recognised among the species of the family to which it belongs, by its sharp-pointed head, with the upper jaw considerably the longest. The length of the head compared with the length of the body alone is as one to three; the depth of the body but two-thirds of the length of the head, and compared to the length of the whole fish is as one to seven: the first ray of the dorsal fin arises half-way between the point of the nose and the end of the fleshy portion of the tail; the third ray of the dorsal fin, which is the longest, is of the same length as the base of the fin: the pectoral fin small; the ventral fins arise, in a vertical line, in advance of the commencement of the dorsal fin, which is over the space between the ventral and anal fins: the base of the anal fin is as long as the distance from its commencement to the origin of the ventral fins; the rays short: the tail deeply forked. The fin-rays in number are—

D. 14 : P. 15 : V. 7 : A. 18 : C. 19.

The breadth of the eye is one-fifth of the length of the whole head; the peculiarity in the comparative length of the jaws has been previously noticed; the gill-covers are elongated; the scales of the body large and deciduous: the colour of the top of the head and back blue, with a tinge of green; irides, gill-covers, sides, and belly, silvery white; the fins delicate in structure, and greenish white; the membranes connecting the rays almost transparent.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.**



THE COMMON COD.

THE KEELING.

Morrhua vulgaris,	Cuvier, Règne An. t. ii. p. 331.	
,, ,,	*Cod,*	Flem. Brit. An. p. 191, sp. 76.
,, ,,	*Codfish, Keeling,*	Willughby, p. 165, L. 1, fig. 4.
,, ,,	Linnæus.	Bloch, pt. ii. pl. 64.
,, ,,	*Common Codfish,*	Penn. Brit. Zool. vol. iii. p. 231.
,, ,,	*Codfish,*	Don. Brit. Fish. pl. 106.
Gadus morrhua,	*Common Cod,*	Jenyns, Brit. Vert. p. 440.

Gadus. *Generic Characters.*—Body elongated, smooth, compressed towards the tail; back furnished with three dorsal fins; ventral fins pointed; abdominal line with two fins behind the anal aperture; the lower jaw with one barbule at the chin; branchiostegous rays 7.

Baron Cuvier's first division of his second order of fishes, those with flexible fin-rays, and with the ventral fins attached to the abdomen, being concluded, the soft-finned fishes of the second division, or those forming his third order, succeed. These are recognised by having the ventral fins placed very near the pectorals; the bones supporting the former being attached to the bones of the shoulder supporting the latter: and this disposition of the ventral fins has been conveniently referred to by the single term subbrachial.

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* The family of the Codfish.

This division includes some of the species most valuable to man as articles of food and commerce: among which may be particularly noticed some of those belonging to the first family, which includes the Common Cod, Haddock, Whiting, and many others to be hereafter referred to, all more or less remarkable for the excellence of their flesh, which is white, firm, separates readily into flakes, is agreeable to the taste, wholesome, and cheap.

The old genus *Gadus* of Linnæus included fishes with one, two, or three dorsal fins, one or two anal fins, with or without barbules or cirri about the mouth, and of very different forms of body. These have been separated by Cuvier, whose first genus includes only those with three dorsal fins, two anal fins, and one barbule at the chin, as the generic characters determine.

The Common Cod is not only one of those species most universally known, but is also one of the greatest intrinsic value, whether we consider the quality of the fish itself, the enormous numbers in which it is taken, or the extensive range over which it exists. In the seas with which Europeans are best acquainted, this fish is found universally from Iceland very nearly as far south as Gibraltar; but it does not exist in the Mediterranean: it is also found and taken in abundance as far west as the shores of Newfoundland.

In this country it appears to be taken all round the coast: among the islands to the north and west of Scotland it is abundant: most extensive fisheries are carried on: and it may be traced as occurring also on the shore of almost every county in Ireland. In the United Kingdom alone, this fish, in the catching, the curing, the partial consumption and sale, supplies employment, food, and profit to thousands of the human race.

The Codfish is very voracious; a favourable circumstance for the fishermen, who experience little difficulty in taking them with almost any bait whenever a favourable locality is ascertained. As these fish generally inhabit deep water, from twenty-five to forty and even fifty fathoms, and feed near the ground on various small fish, worms, crustacea,* and testacea, their capture is only attempted with lines and hooks. Two sorts of lines, adapted for two very different modes of fishing, are in common use. One mode is by deep sea-lines, called bulters, on the Cornish coast: these are long lines, with hooks fastened at regular distances along their whole length by shorter and smaller cords called snoods; the snoods are six feet long each, and placed on the long line twelve feet from each other, to prevent the hooks becoming entangled. Near the hooks these shorter lines, or snoods, are formed of separate threads loosely fastened together, to guard against the teeth of the fish. Some variations occur at different parts of the coast, as to the number of hooks attached to the line, as well as in the length of the snood; but the distance on the long line between two snoods is always double the length of the snood itself. Buoys, buoy-ropes, and anchors or grapples, are fixed one to each end of the long line; the hooks are baited with sandlaunce, limpet, whelk, &c.: the lines are always laid, or, as it is termed, shot, across the tide; for if the tide runs upon the end of the line, it will force the hooks together, by which the whole tide's fishing is irrecoverably lost: they are deposited generally about the time of slack water, between each ebb and flow, and are taken up or hauled for examination after being left about six hours, or one flood or ebb.

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* Mr. Couch has taken thirty-five crabs, none less than the size of a half-crown piece, from the stomach of one Cod.

An improvement upon this more common plan was some years ago suggested by Mr. Cobb, who was sent to the Shetlands by the Commissioners appointed for the improvement of the fisheries. He fixed a small piece of cork within a certain distance of the hook, about twelve inches, which suspended and floated the bait so as to prevent its falling on the ground; by which method the bait was more freely shown to the fish, by the constant and variable motion produced upon it by the tide. In the old way, the bait was frequently hid from the fish by being covered with seaweed, or was consumed by some of the numerous star-fish and crabs that infest the ground.

The fishermen, when not engaged in shooting, hauling, or rebaiting the long lines, fish with hand-lines, armed with two hooks kept apart by a strong piece of wire: each fisherman manages two lines, holding one line in each hand; a heavy weight is attached to the lower end of the line not far from the hooks, to keep the bait down near the ground, where the fish principally feed. These two modes of line-fishing are practised to a great extent nearly all round the coast; and enormous quantities of Cod, Haddock, Whiting, Coalfish, Pollack, Hake, Ling, Torsk, and all the various flat-fish, usually called by the general name of whitefish, are taken. Of Codfish alone, the number taken in one day is very considerable; from four hundred to five hundred and fifty fish have been caught on the banks of Newfoundland in ten or eleven hours by one man; and a master of fishing-vessels trading for the London market told me that eight men, fishing under his orders off the Dogger Bank, in twenty-five fathoms' water, have taken eighty score of Codfish in one day. These are brought to Gravesend in stout cutter-rigged vessels of eighty or one hundred tons' burthern, called storeboats, built for this traffic, with a large well in which the fish are preserved alive; and of these a portion is sent up to Billingsgate market by each night-tide.

Well-boats for preserving alive the fish taken at sea, came into use in this country early in the last century. They are said to have been first built at Harwich about 1712. The storeboats remain as low down as Gravesend, because the water there is sufficiently mixed to keep the fish alive: if they were to come higher up, it would kill them.

A change has lately taken place from the Cod having shifted their ground. Formerly the Gravesend and Barking fishermen obtained few Cod nearer than the Orkneys or the Dogger Bank; but for the last two or three years the supply for the London market has been obtained by going no farther than the Lincolnshire and Norfolk coasts, and even between that and London, where previously very few fish could be obtained.

Cod have been kept in salt-water ponds in different parts of Scotland, and found to maintain their condition unimpaired. Of these ponds there are three; one in Galloway, another in Fife, and a third in Orkney. That in Galloway is at Logan, the seat of Colonel M'Dowall: it is a basin of thirty feet in depth, and one hundred and sixty in circumference, hewn out from the solid rock, and communicating with the sea by one of those fissures that are common to bold and precipitous coasts. A fisherman is attached to this preserve, whose duty it is constantly to supply the fish with the necessary quantity of food, which several species soon learn to take eagerly from the hand. In the course of the fishing for this daily supply, such fish as are not too much injured are placed in the reservoir; the others are cut in pieces for food for the prisoners. The whelks, limpets, and other testacea, are boiled to free them from the shells;

and no sooner does the keeper or his son appear with the well-known basket of prepared food, than a hundred mouths are simultaneously opened to greet the arrival. The Cod-fish are the most numerous in this preserve; one of which has lived twelve years in confinement, and attained a large size.

Dr. Parnell mentions that Cod are observed to thrive better while under confinement than most of the species of the same family, and in some instances they are found improved by the change. Elias Cathcart, Esq. of St. Margaret's, near North Queensferry, has kept for some time a number of marine fishes in a salt-water pond of about two hundred feet in length, and five fathoms deep, in which the tide flows and ebbs twice in the day. The principal fishes preserved are Cod, Haddock, Whiting, Flounders, and Skate, which are retained prisoners by means of an iron grating, placed at that part of the pond which communicates with the Frith. They are fed by the keeper with sprats, young herrings, and other small fishes, besides, occasionally, with the intestines of sheep, which the Cod are observed to devour with avidity. All the fish appear to thrive well, especially the Cod, which are found to be firmer in the flesh and thicker across the shoulders than those obtained from the Frith of Forth, whence the Edinburgh market is supplied. The Cod is abundant in the Orkney and other Scottish Islands.

In a natural state the Cod spawns about February; and nine millions of ova have been found in the roe of one female. The Cod is in the greatest perfection as food from the end of October to Christmas. It may, in fact, be said of the whole of the family of *Gadidæ*, that they are in the best condition for the table during the cold months of the year. The young of the Cod, about six inches long, abound at the mouth of the Thames and Medway throughout the summer: as autumn advances, they gain size and strength, and are caught from twelve to sixteen inches in length by lines near the various sandbanks in the Channel. When of Whiting size, they are called Codlings and Skinners; and, when larger, Tumbling or Tamlin Cod.

On the coast of Durham and Northumberland, and at the Isle of Man, the Cod acquire a dark red or reddish brown colour; and are called Rock Cod, Red Cod, Ware Cod, and Red Ware Cod, when of this particular colour. I saw a considerable quantity in this state in Berwick market, and have had others sent to me by Dr. Johnston. Both the varieties of our Common Cod—for there appears to be two well-marked varieties—were equally red. This colour is considered to be the consequence of particular food obtained while lying among weedy rocks. At a short distance only from the situations named, the Codfish are of the usual ash-green colour.

The largest Codfish I have a record of weighed sixty pounds, was caught in the Bristol Channel, and produced five shillings: it was considered cheap there at one penny the pound. Pennant, however, states that a Codfish of seventy-eight pounds' weight was caught at Scarborough, and sold for one shilling.

There appears to be two well-marked varieties of the Common Cod; one with a sharp nose, elongated before the eye, and the body of a very dark brown colour, which is usually called the Dogger Bank Cod. This variety prevails also along our southern coast. The other variety has a round blunt nose, short and wide before the eyes, and the body of light yellowish ash-green colour, and is frequently called the Scotch Cod. Both sorts have the lateral line white. I believe the distinction of more southern and northern Cod to be tenable, and that the blunt-headed lighter-coloured fish does not range so far south as the sharper-nosed dark fish. Our fishermen now finding plenty of Codfish near home, the London shops for the last year or two have only now and then exhibited specimens of the short-nosed northern Cod: both varieties are equally good in quality, and both are frequently taken on the same ground.

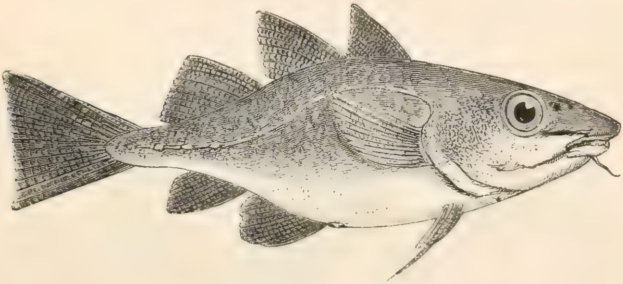
The length of the specimen described was three feet, and the weight about twelve pounds. The length of the head compared to the length of the body alone, without the caudal rays, is as one to two and a half; the depth of the body equal to the length of the head: the first dorsal fin commences in a vertical line just behind the origin of the pectorals; the second dorsal commences in a line over the anal aperture, and ends on the same plane as the first anal fin; the third dorsal fin and the second anal fin begin and finish on the same plane: the tail nearly square; all the rays of the fins covered with an extension of the skin of the body.

The fin-rays in number are—

D. 10. 20. 18. : P. 20 : V. 6 : A. 20. 16. : C. 26. Vertebræ 50.

The head is large; the belly tumid and soft; the body tapering gradually throughout the latter half; the cavity of the abdomen extended internally behind the anal aperture, the intestine being recurved: the upper part of the head, cheeks, back, and sides, mottled and spotted with greenish ash; the belly white; the lateral line white, broadest along the posterior half; all the fins dusky, the first and second dorsal being rather lighter in colour than the rest: a broad band of short teeth on the upper jaw, which is the longest, and on the anterior part of the vomer; a narrower band on the lower jaw, with one elongated barbule at the chin: the irides silvery, the pupil blue; the breadth of the orbit one-sixth of the length of the head.

Some years since, I obtained from a fisherman at the mouth of the Thames a fresh-caught example of a species of *morrhua*, with the middle dorsal and the first anal fins short; the body as deep for its length as the *luscus;* the length of the head compared to the whole length of the fish as one to three. Among the fishermen it was by some considered to be an accidental deformity, with injury of the spine, and their name for it was Lord-fish; others said it was a fish which they met with occasionally, and believed it distinct from any other. A coloured drawing was made at the time, from which the representation here given was taken, but the fish was not preserved. The fin-rays were as stated; and it will be observed, on comparing the numbers, that they do not differ very widely from those of the Common Cod.



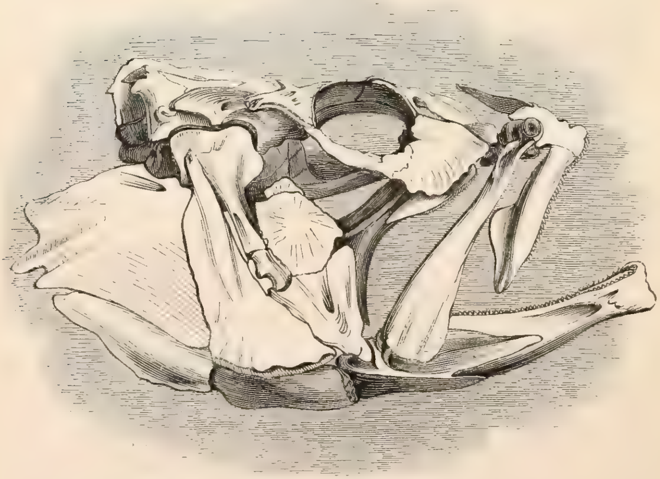
D. 14. 19. 18. : P. 14 : V. 6 : A. 17. 11. : C. 24.

The figure above is taken from the drawing referred to, but carefully reduced: upper part of the head, back, and fins, mottled with two shades of brown; the sides of the body lighter; the belly white; the lateral line white, arching high over the pectoral fins: the irides reddish orange.

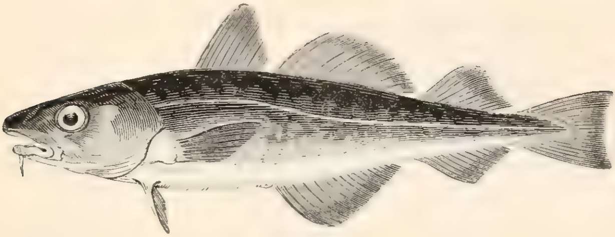
It is probable that this is only an accidental deformity, some injury to the spine having prevented the usual growth.

There is reason to believe that the Speckled Cod of Dr. Turton, represented in his British Fauna as frequently taken in the weirs at Swansea, is only the young of the Common Cod.

The vignette below represents the bones of the head in the Codfish.



SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE DORSE,

OR VARIABLE COD.

Morrhua	*callarias,*	CUVIER, Règne An. t. ii. p. 332.
,,	,,	FLEM. Brit. An. p. 191.
,,	,,	WILLUGHBY, p. 172, L. 1, fig. 1.
Gadus	,,	LINNÆUS. BLOCH, pt. ii. pl. 63.
,,	,,	BERKENHOUT, Syn. edit. 1795, p. 67, sp. 2.
,,	,,	*Variable Cod,* PENN. Brit. Zool. vol. iii. p. 239.
,,	,,	,, ,, JENYNS, Brit. Vert. p. 441.

THE authority upon which this species was originally introduced into the catalogue of British Fishes seems now to be questionable. Neither Berkenhout nor the naturalists who have followed him, in including the name of it, appear to have seen any British example; and Dr. Fleming, who from his northern locality was the most likely to have seen specimens, mentions it only on the authority of others, and does not number it in his series of species. Since the publication of the first edition of this work, Mr. Thompson of Belfast has recorded in the Annals of Natural History the occurrence of this species both in the North and South of Ireland,—namely, the counties of Antrim and Cork.

It appears to be a fish well known in the Baltic, and frequently called the Baltic Cod. It is included by Professor Nilsson in his Fishes of Scandinavia, and seems to be fully entitled to one of its names, that of Variable Cod, four northern varieties appearing to be well known, which are each distinguished there by a particular term referring to peculiarities in the colouring. It spawns in March and April.

Fabricius describes this species as being very numerous in many parts of Greenland; and Captain James C. Ross, in his Natural History, Appendix to the last Arctic Voyage, says, "our having found it on the north coast of the American continent, along the shores of the inlet to the west of the peninsula of Boothia, is an interesting feature in its history. At the same time, the fact that the only four species of fish which were found by us in that inlet, being also common to Davis's Strait and Baffin's Bay, may be considered an additional proof, if any still be wanting, of a water communication between these two seas. It is also worthy of remark, that only two of these four species inhabit the sea on the east side of the isthmus of Boothia."

The last published description of this species that I am acquainted with, and most likely to have been taken from the fish itself, is that by M. Nilsson, before referred to; and it is here given rather than multiply in print any well-known description of older date. I have never seen a specimen of the fish.

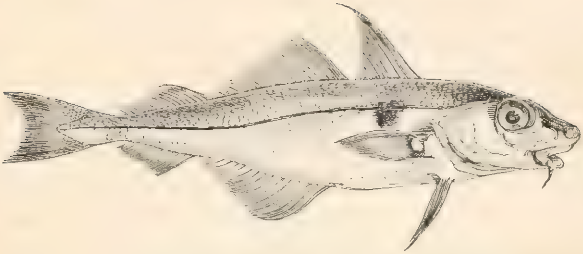
"Body elongated, subventricose; head, back, and sides, more or less spotted; lateral line white, bent; tail square; upper jaw much the longer; snout prominent, sharp; under jaw only half as long as the head, and ending on a line halfway between the nose and the eye."

The fin-rays in number are—

D. 15. 18. 20. : P. 20 : V. 6 : A. 19. 18. : C. 24.

Length from twelve to twenty-four inches.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE HADDOCK.

Morrhua æglefinus, Cuvier, Règne An. t. ii. p. 331.
,, ,, *Haddock*, Flem. Brit. An. p. 191, sp. 77.
,, ,, *Hadock*, Willughby, p. 170, L. 2.
Gadus ,, Linnæus. Bloch, pt. ii. pl. 62.
,, ,, *Hadock*, Penn. Brit. Zool. vol. iii. p. 241.
,, ,, *Haddock*, Don. Brit. Fish. pl. 59.
,, ,, ,, Jenyns, Brit. Vert. p. 441.

The Haddock is almost as well known as the Common Cod; and from the quantity taken at numerous localities round the coast, and the facility with which the flesh can be preserved, it is a fish of considerable value. Besides frequenting the coast of Great Britain, from the extreme north to the Land's End, the Haddock may be traced nearly all round the shores of Ireland; and the largest examples have been taken in Dublin Bay and off the Nymph Bank. Though ranging over a considerable space both north and south of the geographical situation of this country, the Haddock does not exist either in the Baltic or in the Mediterranean.

Haddocks swim in immense shoals, but are uncertain as to their appearance in places that had been formerly visited, and they are prone to change their ground after having arrived. The enormous consumption of food even in a short space of time, when the number of mouths is considered, may be one powerful reason for seeking new localities. They are probably more abundant along our eastern coast, from Yarmouth to the Tyne, than elsewhere. There they are caught with long-lines and hand-lines, and the most attractive baits are pieces cut from the Herring or Sand-launce. Along our southern shore, where the trawl-net is constantly in use, the Haddock, feeding near the bottom, is frequently taken in the trawl. The most common weight of a Haddock is from two to four pounds. I have seen Haddocks of ten pounds' weight in the London market; the Brixham trawling-ground has produced Haddock of fourteen pounds; but the largest seen for some years past weighed sixteen pounds, and was taken in Dublin Bay.

Haddocks spawn in February and March, and the young are six inches long by the beginning of September. When kept in confinement in the salt-water preserve referred to in the account of the Common Cod, the Haddocks were found to be the tamest fishes in the pond, and took limpets one after another from the hand. Their food is small fish, crustacea, and almost any of the inferior animals of the deep, even the spiny Aphrodita. They are in the best condition for the table during the last three months of the year.

The French fishermen call the Haddock, *Hadot*, whence probably our name was derived.

Pennant says, " Our countryman Turner suggested that the Haddock was the *Onos* or *Asinus* of the ancients. Different reasons have been assigned for giving this name to the species, some imagining it to be from the colour of the fish, others because it used to be carried on the backs of asses to market." A different reason appears to me more likely to have suggested the name: the dark mark on the shoulder of the Haddock very frequently extends over the back and unites with the patch of the shoulder on the other side, forcibly reminding the observer of the dark stripe over the withers of the ass; and the superstition that assigns the mark in the Haddock to the impression St. Peter left with his finger and thumb when he took the tribute-money out of a fish of this species, which has been continued to the whole race of Haddocks ever since the miracle, may possibly have had reference, or even its origin, in the obvious similarity of this mark on the same part of the body of the Haddock and of the humble animal which had borne the Christian Saviour. That the reference to St. Peter is gratuitous, is shown by the fact that the Haddock does not exist in the sea of the country where the miracle was performed.

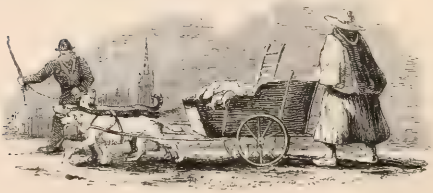
The length of the specimen described was twenty inches. The length of the head compared to the length of the body, without including the caudal rays, is as one to two and a half; the depth of the body less than the length of the head: the first dorsal fin commences in a line over the origin of the pectorals; the second dorsal fin begins in a line over the anal aperture, and ends nearly on the same plane with the first anal fin; the third dorsal fin, and the second anal fin, commence nearly on the same plane, but the base of the first is longer than that of the second: the caudal rays rather long, and the tail slightly forked. The fin-rays in number are—

D. 15. 21. 19. : P. 18 : V. 6 : A. 24. 18. : C. 25. Vertebræ 54.

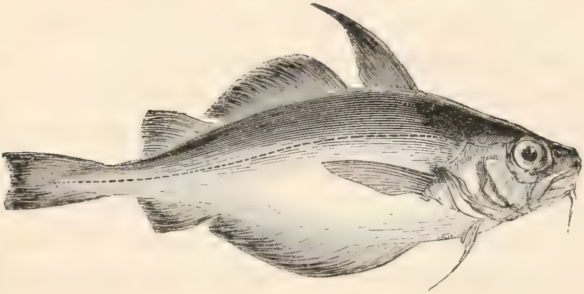
The head slopes suddenly from the crown to the point of the nose; the upper jaw much longer than the lower; the nose projecting beyond the opening of the mouth, which is small; a broad band of short teeth on the superior maxillary bones, and a patch of teeth also, of the same character on the most anterior part of the vomer; lower jaw furnished with a narrow band of teeth: the barbule at the chin small: the eye large; the diameter of the orbit more than one-fourth of the whole length of the head; the irides silvery; the pupil large, somewhat angular in form, and blue: the head, cheeks, back, and upper part of the sides, dull greyish white; lower part of the sides and belly almost white, slightly mottled with grey; the body covered with small scales; the lateral line strongly marked and black; under the middle of the first dorsal fin, but below the lateral line, a black patch, which in many specimens extends over the back and unites with the mark on the other side; the dorsal fins and tail dusky bluish grey; pectoral, ventral, and anal fins lighter.

Dr. D. H. Storer of Boston, in his valuable Report on the Ichthyology of Massachusetts, of which he very kindly sent me a copy, says that immense shoals of the Haddock are found on that coast in the spring, and continue through the season until autumn.—Page 125.

The vignette represents a Scheveling fish-cart.



SUBBRACHIAL MALACOPTERYGII. *GADIDÆ.*



THE BIB, POUT, AND WHITING POUT.

SMELTIE, *Zetland.*—KLEG, *Scarborough.*—BLENS *and* BLINDS, *Devonshire and Cornwall.*

Morrhua lusca,	*Bib,*	Flem. Brit. An. p. 191, sp. 78.
,, *barbata,*	*Pout,*	,, ,, ,, ,, sp. 79.
Asellus luscus,	*Bib & Blinds,*	Willughby, p. 169.
,, *barbatus,*	*Whiting Pout,*	,, App. 22, L. 4.
Gadus luscus,	Linnæus.	
,, *barbatus,*	Linnæus.	Bloch, pt. v. pl. 166.
,, *luscus,*	*Bib,*	Penn. Brit. Zool. vol. iii. p. 247, pl. 34.
,, *barbatus,*	*Pout,*	,, ,, ,, ,, p. 246.
,, *luscus,*	*Bib,*	Don. Brit. Fish. pl. 19.
,, ,,	*Bib or Pout,*	Jenyns, Brit. Vert. p. 442.

The systematic terms which refer to the Bib and Pout are here brought together in the belief that they are but different names for the same fish.

Willughby, in his Ichthyology, page 169, first described his *Asellus luscus*, under its Cornish names of Bib and Blinds. Ray, in his Appendix to Willughby's work, which he edited, admitted from Martin Lister, as a species, the Whiting

Pout of the London market, not aware that it was the same fish as the Bib of Cornwall, which had been already included and described by Willughby himself. Ray continued them as distinct in his own Synopsis, and was followed by Artedi, Linnæus, and others. Bloch, however, and Lacépède have not admitted either in their works; and Pennant, though he gave each fish a place in his British Zoology, was inclined to consider them identical. The excellent figure of the fish given by Ray in Willughby's work, plate L. 4, the possession of specimens obtained from various localities between Berwick Bay on the north-east, and Devonshire in the south-west, and these compared with drawings by Mr. Couch of the Bib of Cornwall, leave no doubt that the *luscus* and *barbatus* of authors are the same fish.

The Bib or Pout, though not abundant, is yet a well-known species, which is found on many parts of our coast, particularly those that are rocky. Northward it appears to range as far as Greenland; and is caught on the coasts of Norway and Sweden. It is taken at Zetland and in the Forth, where, as well as in Scotland generally, it is called the Brassy. I have received specimens from Dr. Johnston, taken at Berwick; and it occurs on the coast of Norfolk. It is common about the mouth of the Thames; and on the Dutch as well as the French coast. Along our southern shore as far west as Devonshire, it is very commonly taken in the trawl-nets; but on the rocky coast of Cornwall it is caught by a baited hook. It has been taken on the coast of Carnarvonshire, at Dublin, at Belfast, and Loch Foyle; and I have no doubt may be found all round the coast.

From a dark spot at the origin of the pectoral fin, in which it resembles the Whiting, one of its most common names is Whiting Pout; and from a singular power of inflating a membrane which covers the eyes and other parts about the head, which, when thus distended, have the appearance of bladders, it is called Pout, Bib,* Blens,* and Blinds.* The flesh is excellent; and, like most of the other fishes of this family, it is in the best condition for the table in November and December. Its food is small fish and the various animals allied to the shrimps. It is most frequently caught in spring, because it then approaches the shore for the purpose of spawning. The largest specimen I have seen measured in length sixteen inches.

The length of the head is to the whole length of the fish as one to four; the depth of the body is greater than the length of the head, and compared to the whole length of the fish as one to three and a half; the first dorsal fin commences in a vertical line a little behind the origin of the pectoral fin; the longest ray longer than the base of the fin: the rays of the second dorsal fin are short; the base of it as long again as the base of the first dorsal fin, and ending nearly on the same plane as the first anal fin; the base of the third dorsal fin is nearly as short as that of the first dorsal, commencing and ending on the same plane with the second anal fin, and both are similarly truncated. The ventral fins are considerably in advance of the line of the origin of the pectorals; the first two rays elongated, and divided at the ends: the anal aperture is in a line under the origin of the pectoral fins, but the cavity containing the intestines extends much farther back; the first anal fin commences nearly in a line with the beginning of the first dorsal, and ends on a line with the ending of the second dorsal; the rays forming the middle portion of the fin the longest, the others declining in length towards each extremity: the second anal fin, as before mentioned, in extent of base and form like the third dorsal: the tail long, the end of the rays nearly square.

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* Probably derived from Bleb and Blain, two old words meaning a blister or a bubble in the water.

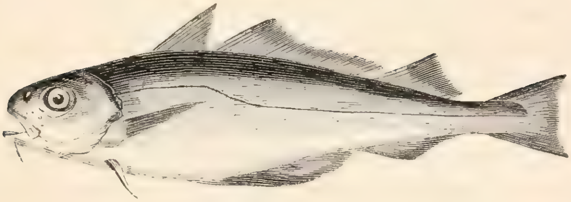
The number of fin-rays :—

D. 11. 20. 16. : P. 18 : V. 6 : A. 33. 19. : C. 21. Vertebræ 48.

In the tails of the fishes of this family there are many short rays which are not counted, being outside the longest ray above and below.

In form the Whiting Pout is the deepest for its length of the British *Gadidæ :* the upper jaw is the longest; the band of teeth of several rows, those forming the outer row the largest; under jaw with a single row; the barbule at the chin rather long; various mucous pores about both jaws: the eyes large; the orbits covered with a loose membrane which the fish has the power of distending; the diameter of the eye equal to one third of the length of the head; the irides orange colour: the dorsal and abdominal lines exhibit considerable convexity; the body tapers rapidly from the line of the ending of the second dorsal and first anal fins: the colour of the head, back, and upper part of the sides, a yellow reddish brown, becoming lighter on the belly, and tinged in places with bluish grey; at the base of the pectoral fins a black spot: scales small and deciduous: posterior half of the lateral line straight, then rising in a curve over the pectoral fin; all the fins, except the ventrals, dusky brown; the ventrals nearly white; the first anal fin in large-sized specimens edged with fine blue.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE POOR, OR POWER COD.

Morrhua minuta,		*Poor,* Flem. Brit. An. p. 191, sp. 80.
Gadus minutus,		Linnæus. Bloch, pt. ii. pl. 67, fig. 1.
,,	,,	*Power,* Penn. Brit. Zool. vol. iii. p. 249, pl. 34.
,,	,,	Willughby, p. 171.
,,	,,	Ray, Syn. p. 163, fig. 6.
,,	,,	*Poor,* Jenyns, Brit. Vert. p. 444.

The Poor, or Power Cod, though somewhat similar in general appearance to the Pout last described, is yet readily to be distinguished from it by several well-marked characters. It is not so deep when of the same length; the first anal fin does not begin so far forward as in the Pout by nearly the whole length of the base of the first dorsal fin; the longest rays of the third dorsal fin and the second anal fin are shorter than the bases of the respective fins, and do not, therefore, produce the same vertically truncated appearance as in the same relative fins of the Pout; and the barbule at the chin is much shorter.

The Power, or Poor Cod, the smallest of its genus, so called, it is said, on account of its diminutive size, seldom exceeding six or seven inches in length, and therefore comparatively of little value, was first described as an English fish by Dr. Jago, of Cornwall, and was introduced by Ray at the end of his *Synopsis*, with a figure which particularly exhibits the specific distinctions afforded by the form and situation of the fins, which has been already adverted to, and by which it may be immediately recognised.

Bloch says that the appearance of this fish in the Baltic is a source of pleasure to the fishermen. It is called the fish-conductor; and excites great hopes of a rich harvest among the larger species of the genus, the Cod, and others, which follow in the rear, preying relentlessly on their more diminutive generic companions: the fishermen in their turn prey upon them.

Mr. Couch says it frequents the edges of rocks, is caught by the hook, and, though always good for the table, is, on account of its small size, chiefly used for bait. Montagu says it is taken frequently on the Devonshire coast with the hook, and also in the crab-pots. In the nets worked on that coast it is caught along with the Bib, the fishermen selling both as Whiting Pout.

It is included by Mr. Thompson in his catalogue of the Fishes of Ireland, as occurring occasionally on various parts of the coast, both in the north and south.

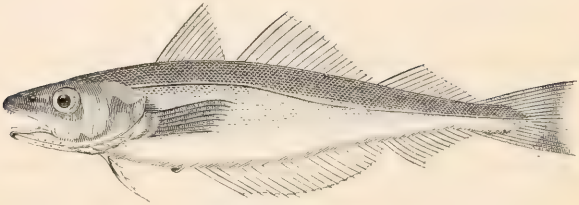
Dr. Storer, in his Report, already referred to, and which will be frequently quoted in reference to American fishes, says that this species has been taken once in the harbour of Boston, but has not been previously noticed as belonging to the American shores.

The length of the head compared to the whole length of the fish is as one to five; the depth of the body rather more than the length of the head: the first dorsal fin begins behind the line of the origin of the pectorals: the longest ray as long as the base of the fin: the second dorsal fin begins and ends on the same planes with the first anal fin; the base of the second dorsal fin as long again as the base of the first dorsal fin; the base of the third dorsal fin rather more than half as long as that of the second dorsal; the third dorsal and the second anal fins begin and end on the same planes, and the peculiarity of their forms has been referred to. The vent, or anal aperture, is in a line under the most posterior portion of the first dorsal fin; the first anal fin begins immediately behind the vent, and under the commencement of the second dorsal fin; the second anal fin has been noticed; the tail is long, with the rays slightly forked. The number of fin-rays:—

D. 12. 19. 17. : P. 14 : V. 6 : A. 25. 17. : C. 18.

The head is short and the nose blunt: the barbule at the chin neither so long nor so slender as in the Pout; several mucous pores about the mouth: the eye large; the breadth equal to one-third of the length of the head; the irides orange: the scales of the body minute and deciduous; the lateral line but slightly curved, and that only where it rises over the pectoral fin: the upper part of the head and back brownish yellow, becoming lighter on the cheeks and sides; the belly dirty white; pectoral, dorsal fins, and tail, yellow brown, darker at the edges; ventral and anal fins dirty yellowish white.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE WHITING.

Merlangus vulgaris,	Cuvier,	Règne An. t. ii. p. 332.
,, ,,	*Whiting,*	Flem. Brit. An. p. 195, sp. 91.
,, ,,	,,	Willughby, p. 170, L. 5.
Gadus merlangus,	Linnæus.	Bloch, pt. ii. pl. 65.
,, ,,	*Whiting,*	Penn. Brit. Zool. vol. iii. p. 255.
,, ,,	,,	Don. Brit. Fish. pl. 36.
Merlangus vulgaris,	,,	Jenyns, Brit. Vert. p. 445.

Merlangus. *Generic Characters.*—The same as those of *Morrhua*, except that they have no barbule at the chin.

The Whiting is well known for the excellence of its flesh, surpassing in delicacy that of any of the other species of the valuable family of fishes to which it belongs: the pearly whiteness of its flaky muscles, added to its extreme lightness as an article of food, recommend it particularly to invalids who are unable to digest more solid nutriment.

It is caught in great abundance almost all round our coast, and may be traced from the Orkneys to Cape Clear. Whitings of several pounds' weight have been caught as far north as the Dogger Bank; they have been taken also of nearly equal size on the coast of Cornwall; and on the Nymph Bank, along the extended line of the south coast of Ireland. In that country they have also been found on the eastern coast from Waterford to Antrim, and from thence north and west as far as Lough Foyle.

The fishing for Whiting with lines is pursued nearly all the year through; but the fish is most plentiful in the months of January and February, when it comes in large shoals towards the shore for the purpose of depositing its spawn, and is taken in abundance within half a mile, and seldom exceeding three miles, from land. A much larger quantity than is consumed while fresh being frequently taken, a portion is easily preserved either by salting or drying.

The Whiting is a voracious feeder, and seizes indiscriminately any of the mollusca, worms, small crustacea, and young fishes. I remember to have taken several Sprats from the stomach of a Whiting; and Mr. Couch has known four full-grown Pilchards taken from the inside of a Whiting that weighed four pounds. It appears to prefer sandy banks, but shifts its ground frequently in pursuit of the various fry of other fishes, upon which it principally subsists.

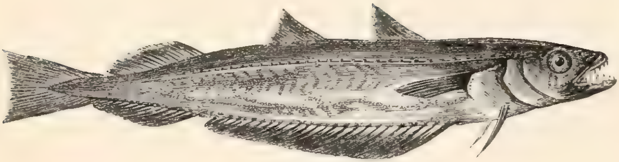
Though occasionally occurring in the London market of three or four pounds' weight, the most usual size is from twelve to sixteen inches in length, and weighing about one pound and a half.

The length of the head compared to that of the body alone is as one to three; the depth of the body not equal to the length of the head, or compared to the whole length as one to six. The first dorsal begins behind the line of the origin of the pectorals and before the line of the vent; the second dorsal and first anal fins end on the same line; the third dorsal and second anal fins begin and end on the same plane; the ventral fins are placed very forward; the second ray elongated: the anal aperture is in a line under the middle of the first dorsal fin; the first anal fin commencing just behind the vent; the tail elongated; the end nearly square. The fin-rays are—

D. 13. 19. 18. : P. 19 : V. 6 : A. 31. 20. : C. 30. Vertebræ 55.

The body of the Whiting, like the bodies of those belonging to this division, is longer for its depth than that of the Codfish; the scales small, oval, and deciduous; the lateral line dark and straight posteriorly, but rising gradually throughout the anterior half; the head elongated; the mouth and gape large; the tongue white and smooth; the upper jaw decidedly the longest, with one row of large and sharp-pointed teeth on the outer edge, and several rows of smaller ones within; the vomer with a few teeth arranged in a semicircular line on the anterior part; the lower jaw with various mucous orifices along the under surface, and a single row of sharp teeth along the upper outer edge, which, when the mouth is closed, range within the outer row of teeth on the upper jaw: the eye in breadth less than one-fourth of the head, and placed more than its breadth from the end of the nose; the irides silvery; the pupils blue. The upper part of the head and the back above the lateral line pale reddish ash brown; sides and belly silvery white; pectoral, caudal, and dorsal fins, pale brown; ventral and anal fins almost white; the pectoral fins each with a decided dark patch at the base.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



COUCH'S WHITING.

Merlangus albus.

Gadus albus,	Risso, Ichth. p. 115.
Merlangus poutassou,	,, Hist. vol. iii. p. 227.

In the month of May 1840 I received a communication from Mr. Couch of Polperro to the following effect:—"On the 5th of this month I had the good fortune to procure a new species of the *Gadidæ*,—new at least to Britain: it is the species described by M. Risso in his Ichthyology of Nice, page 115, and suspected by him not to be the Whiting of the Northern ocean, from which it differs in several decisive particulars."

M. Risso makes but few observations upon this fish either in his single volume on the Ichthyology of Nice, published in 1810, or in his Natural History of the Productions of the Environs of Nice, published in five volumes in 1826. He says it inhabits the sea of Nice, and is taken at all seasons; that it spawns in the spring, and that its flesh is rather soft. This quality of the flesh of the Whiting of the Mediterranean was mentioned to me by Dr. Lush, the superintendent of the Botanic Garden at Bombay, on his recent visit to this country. M. Risso, in his Ichthyology, refers for an illustration of his fish to Bloch's plate 65, which is that of our well-known and common Whiting; but a glance at the two figures here given, will show the distinctions, which M. Risso was aware of, as he adds, " this fish appears to me to be a new species: I invite naturalists to compare it with those of the Northern seas."

The fin-rays, as given by M. Risso in the two works already quoted, are as follows:—

D. 12. 12. 22. : P. 18 : V. 7 : A. 28. 20. : C. 38. Hist.
D. 12. 10. 20. : P. 20 : V. 6 : A. 34. 22. : C. 36. Ichth.

The fin-rays as given by Mr. Couch are—

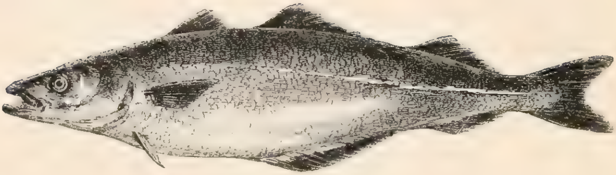
D. 13. 12. 22. : P. 20 : V. 6 : A. 35. 25. Vertebræ 53.

Mr. Couch's description is as follows:—

" Length fifteen inches; the depth in a straight line, two inches and a half: from the base of the first dorsal fin to the vent, along the curve, three inches; from the mouth to the edge of the gill-covers, three inches; from the same to the anterior edge of the eye, one inch; the eye large, the form a perpendicular oval; under jaw the longest; the upper maxillary bone terminal, the snout receding from it backward, contrary to the form of the Whiting, in which the upper jaw is under a projection; the general form of the body resembles that of a Whiting, but rather more slender; the back rounded, as if the specimen was plump, thus showing its slender form not to be the result of emaciation; teeth in the jaws as in the Whiting; on the roof of the mouth a pair of prominent, sharp, incurved teeth; lateral line straight, and passing near the back; another line along the middle of the body formed by the meeting of the muscles; the body ending arrow-shaped at the caudal fin; the first dorsal fin begins over the posterior third of the pectoral; the second dorsal fin like the first in form and elevation, both being triangular; between them a space about equal to their separate breadth; nearly twice this breadth between the second and the third dorsal fins; the beginning of the third dorsal fin is slightly anterior to that of the second anal fin; caudal fin shaped as in the Whiting, but less wide; the pectoral fin ends opposite the middle of the first dorsal fin; ventral fins small and slender, placed rather high on the side, and much like those of the Whiting Pollack (*Merlangus Pollachius*); the longest fibre measures seven-eighths of an inch; from the point of the under jaw to the vent, four inches and one quarter; from the centre of the vent to the commencement of the first anal fin, one quarter of an inch; first anal fin long, widest in the middle; the second anal longer than the third dorsal, both end close to the caudal fin: colour brown; belly white; a dark spot at the upper margin of the pectoral fin; along the base of the anal fins a broad white band; no such band at their margin. The distinctions between this fish and the Whiting are obvious, in the jaws, fins, lateral line, colour, and vertebræ. The brilliant white along the base of the anal fins remained unaltered, after the brilliancy of all beside had considerably changed. The muscular substance of the fish was more pulpy than that of the Whiting. It was taken with an ordinary bait, at a few miles from land."

The figure given at the head of this subject was carefully reduced from the drawing sent me by Mr. Couch; and I beg here to record my sincere acknowledgement and thanks to him for his obliging communication.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE COALFISH.

Merlangus	*carbonarius,*		Cuvier, Règne An. t. ii. p. 332.
,,	,,	*Coalfish,*	Flem. Brit. An. p. 195, sp. 93.
,,	,,	*Colefish,*	Willughby, p. 168, L. 3.
Gadus	,,	,,	Linnæus. Bloch, pt. ii. pl. 66.
,,	,,	*Coalfish,*	Penn. Brit. Zool. vol. iii. p. 250.
,,	,,	,,	Don. Brit. Fish. pl. 13.
Merlangus	,,	*Coal-Fish,*	Jenyns, Brit. Vert. p. 446.

The Coalfish is most decidedly a northern fish, but, being a hardy species, is not without considerable range to the southward. It was the only fish found by Lord Mulgrave on the shores of Spitzbergen; and the fry, only four or five inches in length, were caught with the trawl-net on the west coast of Davis's Straits, during the first voyage of Captain Sir Edward Parry. It is found on the coast of the United States. It abounds in all the northern seas and in the Baltic, and may be said to swarm in the Orkneys, where the fry all the months of summer and autumn are the great support of the poor. Dr. Neill, in his tour of the islands of Orkney and Shetland, saw an old man, and perhaps one or two boys, seated upon almost every projecting rock, holding in each hand a wand or fishing-rod, and catching young Coalfish as fast as they could bait their hooks.

As an article of food, it is more prized when small than when of large size. The flesh of specimens weighing from fifteen to thirty pounds is usually preserved, either salted or dried.

This fish has more provincial names than any other species, some of which only refer to it when of a particular size. Among the Scotch islands the Coalfish is called Sillock, Piltock, Cooth or Kuth, Harbin, Cudden, Sethe, Sey, and Grey-Lord. In Edinburgh and about the Forth the young are called Podleys; at Newcastle the fry are called Coalsey; and, when twelve inches long, Poodlers. Many are caught along shore; and frequently, also, from a boat rowed gently, the angler using a rod in each hand, and trailing a fly from each line.

Mr. Couch says, "It is in the highest condition from October to December, at which season it prowls after prey in large companies; so that when met with they prove a valuable capture to the fishermen: for though but coarse food, yet being wholesome, substantial, and cheap, they are eagerly purchased by the poor either fresh or salted. They swim at no great depth, and with great rapidity; but when attracted by bait, will keep near a boat until all are taken; and I have known four men with two boats, two men in each boat, take twenty-four hundred-weight with lines in a very few hours. The season for spawning is early in spring; immediately after which this fish becomes so lank as to be worthless, in which state it continues through the summer."

In the Orkneys, according to Mr. Low, the young appear about May; in the Tyne, about June; and on the Cornish coast in July. The adult fish are called Rauning Pollacks by the Cornish fishermen: rauning being the ancient and even the popular modern pronunciation of ravening, used in reference to voracity.

The Coalfish may be traced on the Irish coast from Waterford along the eastern shore to Belfast, under the various names of Black Pollack, Blockin, and Grey-Lord.

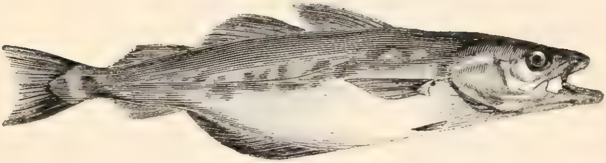
When detained and well fed in a salt-water pond, Coalfish acquire large size. "They were bold and familiar; floating about slowly and majestically, till some food was thrown to them; this they seized voraciously, whether it consisted of shell-fish or ship-biscuit. They would also occasionally approach the margin and take food from the hand."—*Jesse's Gleanings.*

From the point of the lower jaw to the end of the operculum the length is to that of the body and tail as one to three and a half; the depth of the body about equal to the length of the head: the first dorsal fin begins behind the line of the origin of the pectoral fin and before the line of the vent; the second dorsal and the first anal fins end together nearly on the same plane; the third dorsal and second anal fins nearly parallel: the fleshy portion of the tail elongated; the rays forked: the ventral fins small; and the rays of the pectoral fin only extending as far as the line of the vent. The fin-rays are—

D. 11. 20. 20. : P. 19 : V. 6 : A. 24. 19. : C. 32.

The head and body elegantly shaped; the scales small and oblong; the lateral line silvery white and nearly straight; the upper part of the head and the back above the lateral line almost black; much lighter in colour below the line, becoming greyish white with golden reflections on the sides and belly; pectoral, caudal, and dorsal fins, bluish black; ventral and anal fins greyish white: the upper jaw rather the shortest; the lips tinged with purple red; the mouth black; the teeth very small; the irides silvery white; the pupil blue.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE POLLACK.

WHITING POLLACK. LYTHE, *Scotland.*

Merlangus	*pollachius,*	Cuvier, Règne An. t. ii. p. 333.
,,	,,	*Pollack,* Flem. Brit. An. p. 195, sp. 92.
,,	,,	*Whiting Pollack,* Willughby, p. 167.
Gadus	,,	Linnæus. Bloch, pt. ii. pl. 68.
,,	,,	*Pollack,* Penn. Brit. Zool. vol. iii. p. 254.
,,	,,	*Whiting Pollack,* Don. Brit. Fish. pl. 7.
Merlangus	,,	*Pollack,* Jenyns, Brit. Vert. p. 446.

The Pollack is much less abundant on some parts of the coast than the Coalfish ; but, like that species, is an inhabitant of the seas all round our shores. Mr. Low, in his "Natural History of the Orkneys," says, "They are frequently caught close in with the shore, almost among the sea-ware, and in deep holes among the rocks. They seem to be a very frolicsome fish ; and I have been several times fishing for them when they would keep a constant plashing in the water. They bite keenly, scarce allowing the hook to be in the water before one or other jumps at it. They are better eating than the Coalfish ; but I do not know whether they are ever dried or preserved otherwise, as the quantity caught is scarce worth curing." Hand-line fishing for Pollacks, Mackerel, &c. is called whiffing.

This fish is called Lythe in Scotland, as already quoted; but whether this term is intended to refer to its supple, pliant activity, or is derived from *lithos*, a stone, from its living among rocks, I have not seen stated. Fine specimens of the Pollack are taken about the rocky coast of Scarborough, where they are called Leets.

The Pollack is caught at Hastings and Weymouth. Colonel Montagu says it is frequently taken in Devonshire, where it is bought by the inexperienced as Whiting. When only twelve or fourteen inches long, the flesh possesses a considerable portion of the pearly appearance and delicacy of that fish.

Mr. Couch says, "The Pollack is at all seasons one of our most common fishes, but it is not gregarious except in pursuit of prey; and it rarely wanders far from its usual haunts, which are along the edges of rocks, where, with the head directed towards the coming tide, it is ready for any prey that approaches. The smaller ones, which occupy such a station covered with oreweed, have their colours very bright, and the belly of a saffron yellow; while on clean ground they are less brilliant. In summer evenings, they are often seen eager in pursuit of the sandlaunce, frequently spring from their element, and are often taken by anglers from the rocks and piers. The Pollack spawns in winter near the land; and the young abound near the edge of the tide in rocky ground at the beginning of summer."

In Ireland, the Pollack may be traced as occurring on the coast of the counties of Cork, Waterford, Dublin, Antrim, Londonderry, and Donegal, under the names of Pollack, Laith, and Lythe.

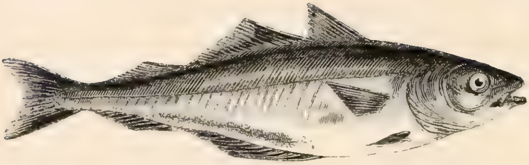
The length of the head compared to that of the body is as one to three and a half; the depth of the body is to the whole length of the fish as one to four and a half: the first dorsal fin begins, as in the Coalfish, behind the line of the origin of the pectoral fin, and before the line of the situation of the vent; the second dorsal fin and the first anal fin end on the same line; the third dorsal fin and the second anal fin begin and end very nearly on the same plane; the first ray of each of the dorsal fins the longest; the ventral fin very small; the anal aperture in a line under the middle of the first dorsal fin; the fleshy portion of the tail long and slender; the end of the rays concave. The fin-rays in number are—

D. 12. 19. 15. : P. 19 : V. 6 : A. 24. 16. : C. 31.

The lower jaw is much the longest; the mouth and lips red, with various mucous orifices about them; the irides silvery; the sclerotic coat cartilaginous; the upper angle of the operculum produced; the body elongated; the upper part of the head and the back above the lateral line olive brown; the sides dull silvery white mottled with yellow, and in young fish spotted with dull red; the lateral line dusky, curved over the length of the pectoral fin, then descending and passing in a straight line to the tail; the dorsal fins and tail brown; the pectoral and anal fins brown edged and tinged with reddish orange.

In December 1839, my kind friend, Robert Ball, Esq. of Dublin, sent me notice of a curious monstrosity observed in a Pollack caught during the previous spring, remarkable for the great elongation of the rays of the first dorsal fin, which had grown to more than three times their usual length.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE GREEN COD.

Merlangus virens, CUVIER, Règne An. t. ii. p. 33.
,, ,, FLEM. Brit. An. p. 195, sp. 94.
Gadus ,, LINNÆUS.
,, ,, *Green Cod*, PENN. Brit. Zool. vol. iii. p. 253.
Merlangus ,, ,, ,, JENYNS, Brit. Vert. p. 447.

THE GREEN COD was first added to the catalogue of British Fishes by Pennant, on the authority of Sir Robert Cullum, Bart.; and if a distinct species, which some have doubted, it is not only abundant, but has an extensive range.

It is mentioned as an inhabitant of the northern seas by Linnæus and others, and is included in the recently published works of Professors Nilsson and Reinhardt, who have devoted particular attention to the fishes of Scandinavia. Dr. Neill says it is taken in the Frith of Forth during summer; and Mr. Couch obtains it on the Cornish coast of eight or ten inches in length. Mr. Forbes and Mr. Wallace tell me it is abundant at the Isle of Man.

This fish is by some considered as the young of the Coal-fish, and by others as the young of the Pollack. It appears, however, to be decidedly distinct from the Pollack, in having its jaws nearly equal in length: in the Pollack the under jaw is by much the longest; the lateral line in the Green Cod is straight, in the Pollack the lateral line is curved over the whole length of the pectoral fin. Mr. Couch in his MS. considers the Green Cod as the young of the Coalfish, with which it certainly agrees in both the particulars in which it differs from the Pollack, but differs also decidedly in colour from the Coalfish. It seems to combine in itself the colouring of the Pollack with some of the peculiarities of the Coalfish, but appears also to be deeper for its length than either; though if the young of a large species, judging by analogy, that would not be the case.

Following the example of the Northern naturalists, who have opportunities of making constant comparison between this fish and the Coalfish from the abundance of both, and who have hitherto considered them distinct, the Green Cod is here allowed a separate place. The figure is from a drawing by Mr. Couch, whose opinion is entitled to attention; and the subject invites the investigation of those who are so located as to be able to obtain examples of both.

Not possessing a specimen, the description here given is derived from the Prodromus of M. Nilsson. The under jaw scarcely longer than the upper; the tail deeply forked; the lateral line straight, white; the colour of the back dark green, passing by degrees into silvery grey on the sides.

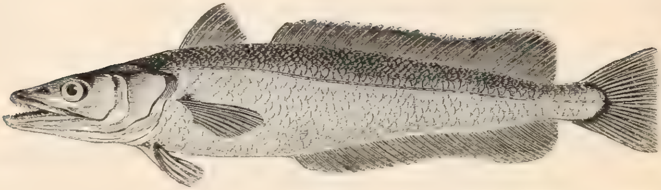
From six to twelve inches is the usual size allowed to the Green Cod; M. Nilsson gives it a length from two to three feet, and adds that it spawns in winter.

The number of fin-rays as stated by Linnæus:—

D. 13. 20. 19. : P. 17 : V. 6 : A. 24. 20. : C. 40.

Dr. Fleming adds, "Teeth in the upper jaw, numerous, strong."

SUBBRACHIAL MALACOPTERYGII. *GADIDÆ.*



THE HAKE.

Merlucius vulgaris, Cuvier, Règne An. t. ii. p. 333.
,, ,, *Common Hake,* Flem. Brit. An. p. 195, sp. 95.
,, ,, *The Hake,* Willughby, p. 174.
Gadus merlucius, Linnæus. Bloch, pt. v. pl. 164.
,, ,, *Hake,* Penn. Brit. Zool. vol. iii. p. 257.
,, ,, ,, Don. Brit. Fish. pl. 28.
Merlucius vulgaris, Common Hake, Jenyns, Brit. Vert. p. 447.

Merlucius. *Generic Characters.*—The head flattened; the body elongated; the back furnished with two dorsal fins; the first short, the second long; but one anal fin, also very long; no barbule at the chin.

The Hake is another of the species belonging to this large and valuable family of fishes, which has an extensive range, being found in the seas of the North of Europe, and also in the Mediterranean.

Though inhabiting the seas of the western coast of Norway, and included by Linnæus in his Fauna Suecica, Dr. Fleming says it is rare in Scotland; and it appears to be most abundant along the southern coast of England. Portsmouth market receives an abundant supply, which is brought by fishing-boats from the Devonshire coast; and Montagu says there is also an abundance in the market of Plymouth.

According to Mr. Couch, "The Hake is a roving fish on the Cornish coast, without much regularity in its movements. From January to April, which is its season for spawning, it keeps near the bottom, and loses the great voracity by which it is characterised at other times, so that multitudes of them are caught in trawls, and but few with a line; but, when Pilchards approach the shores, it follows them, continuing in incalculable numbers through the winter. It rarely happens that Pilchards are taken in a sean without many Hakes being enclosed with them; and thus, when the net remains in the water for several days, they have an opportunity of glutting themselves to their heart's desire, which is to such an extent as to render them helpless, and I have seen seventeen Pilchards taken from the stomach of a Hake of ordinary size. Their digestion, however, is quick, so that they speedily get rid of their load; and fishermen observe that, when hooked, the Hake presently evacuates the contents of the stomach to facilitate its escape; so that when hundreds are taken with a line, in the midst of prey, not one will have anything in its stomach: when near the surface, however, this rejection does not take place until after they are dragged on board."

The Hake may be traced nearly all round the coast of Ireland; and is so abundant in the Bay of Galway, that, according to a recent writer, this bay is named in some ancient maps the *Bay of Hakes.* On that part of the Nymph Bank off the coast of Waterford, this fish is also so plentiful, that one thousand have been taken by six men with lines in one night. It is a voracious fish, as its systematic name of *merlucius*, Seapike, implies. It is a coarse fish, not admitted to the tables of the wealthy; but large quantities are annually preserved both by salting and drying, part of which is exported to Spain.

The Hake is very common on the northern shore of the Mediterranean, and considerable traffic is carried on with this fish; they are packed with aromatic plants, and sent to the towns removed from the coast. The Hake is described and figured by Rondeletius, and was known to the older naturalists before him.

A Hake of three feet eight inches long in the shop of a London fishmonger, in May 1835, supplied the means of obtaining the following particulars. The length of the head, compared to the length of the body alone, as one to three; the depth of the body not so great as the length of the head: the ventral fins are placed in advance of the pectorals; the rays not unequally elongated: the pectoral fins commence in a line under the posterior angle of the operculum; the rays ending with the end of the first dorsal fin: the first dorsal fin itself short and triangular in shape; the second dorsal fin commences in a line over the vent; the anal fin begins immediately behind the vent; both the second dorsal fin and the anal fin terminate on the same plane, near the tail; the rays of both, towards the end, elongated; the caudal rays about three inches long, and nearly even. The fin-rays in number are—

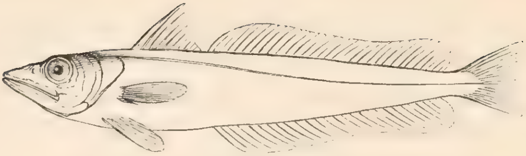
D. 10. 29. : P. 11 : V. 7 : A. 21 : C. 19.

The head is depressed: the inside of the mouth and gill-covers black; lower jaw the longest; teeth slender and sharp, in a single row in each jaw: the irides yellow with a dark outer circle. The lateral line of the body straight throughout the posterior half, then gradually rising to the upper edge of the operculum; the appearance of the lateral line is that of one white line between two dark ones: the scales large; colour of the body dusky brown above, lighter beneath; dorsal and caudal fins dark; ventral and anal fins pale brown.

I have inserted a new figure of our Hake at the commencement of this subject; the figure used in the former edition, and which now, for comparison, is inserted as a tail-piece, does not sufficiently exhibit the elongation of the rays at the posterior part of the second dorsal and anal fin, the rays being represented as rather adpressed, and appearing shorter than they were intended to be. This has, I fear, led to some misconception, as the following extracts seem to show.

In a communication from the Rev. R. T. Lowe, M.A. printed in the Proceedings of the Zoological Society for the year 1840, page 36, describing certain new species of Madeiran Fishes, and containing additional information relating to those already described, Mr. Lowe observes, "The Madeiran Hake, or Pescada, *Merlucius vulgaris* of my Synopsis, page 189, proves, upon better acquaintance, distinct from the common British Hake, Cuvier, Yarrell, &c. *Gadus merlucius*, Linn. Instead of being even, the dorsal and anal fins are each produced at their hinder end into a rounded lobe; the jaws are nearly equal in length; the teeth are large and numerous; the scales small. I do not name it, for I believe it has already been called by Mr. Swainson *M. sinuatus;* and I am doubtful whether it may not also be the *M. esculentus* of Risso, vol. iii. p. 220, though in his synonyms he has confounded it with the true Northern Hake. I believe it to be the fish imperfectly figured long ago by Salvianus, p. 73, copied by Willughby, t. L. membr. 2, n. 1, which has usually been referred to also as the Northern Hake."

Mr. Swainson's remarks in his Natural History and Classification of Monocardian Animals, more especially Fishes, vol. i. p. 319, are as follow:—"To the first of these (the *Merlucinæ*), named by Rafinesque *Merlucius*, after the *Gadus merlucius* of Linnæus, belongs the common Hake, peculiar to the Northern seas, with which the Mediterranean Hake (*M. sinuatus*, Sw. fig. 73), now for the first time



described, has hitherto been confounded by all writers: we presume this is the species, which, under the belief that it was the common one, Cuvier says is abundant in the Mediterranean."

It is to be regretted that Mr. Swainson has not mentioned the characters upon which he founds his distinction between the Mediterranean and the Northern Hake; the name and the figure given, which is here copied, are the only guides. If the specific term *sinuatus* is intended to refer to the form of the dorsal and anal fins as a distinguishing character, it may be desirable to state that the figures of the common Hake, as given by Duhamel and Bloch, present the same peculiarities, particularly in reference to the elongation of some of the posterior rays of the dorsal and anal fins. Pennant, in describing our British Hake, says of the second dorsal fin, " of which the last rays are the highest." Mr. Couch, who lives on a part of our coast which abounds with Hakes occasionally, sends me word, in answer to my inquiry, that the new figure here employed at the commencement of this subject is a good representation of the general form of our Hake, but that the degree of extension of the fin-rays and the character of the waved line formed by the margin of the fins are varied in different specimens of the fish. Dr. Parnell, in his minute description of the Hake found in the Frith of Forth, says of the second dorsal fin, " the first twenty-two rays of equal length, as long as the sixth ray of the first dorsal, the twenty-third to the twenty-seventh rapidly increasing: the remaining rays gradually diminishing, the last very short." Of the anal fin, Dr. Parnell says, "the first, second, and third rays gradually increasing in length, the following eighteen about equal height; the twenty-seventh considerably the longest, the rest gradually diminishing, the last very short." Lastly, I may add, that the representation of the Northern Hake in the work now in progress of the Fishes of Scandinavia by MM. Fries and Ekström exactly accords with the new figure here engraved.

I have no reason to suspect that I made any mistake either in the counting or the printing the number of the various fin-rays in the specimen I examined; but there are considerable differences when compared with the enumeration by Pennant and Dr. Parnell: thus the numbers are according to Pennant—

D. 9. 40. : P. 12 : V. 7 : A. 39.

According to Dr. Parnell—

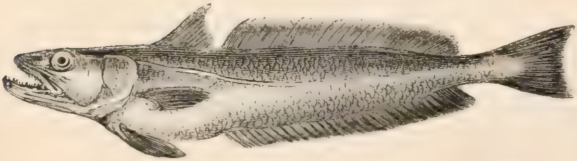
D. 10. 39. : P. 14 : V. 7 : A. 37 : C. 20.

The Hake, according to Dr. Mitchell and Dr. Storer, appears to be taken both at New York and at Boston. The fin-rays as given by Dr. Mitchell:—

D. 12. 38. : P. 13 : V. 7 : A. 41 : C. 27.

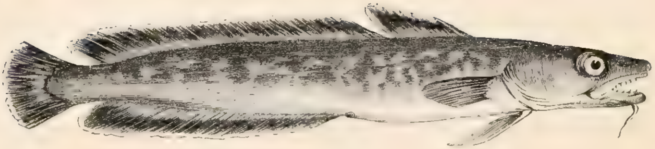
Dr. Storer:—

D. 12. 38. : P. 13 : V. 7 : A. 39.



SUBBRACHIAL
MALACOPTERYGII.

GADIDÆ.



THE LING.

Lota molva,		Cuvier, Règne An. t. ii. p. 333.
Asellus longus,		Willughby, p. 175, L. 2.
Gadus molva,		Linnæus. Bloch, pt. ii. pl. 69.
,, ,,	*Ling,*	Penn. Brit. Zool. vol. iii. p. 262.
,, ,,	,,	Don. Brit. Fish. pl. 102.
Molva vulgaris,	*Common Ling,*	Flem. Brit. An. p. 192, sp. 82.
Lota molva,	*Ling,*	Jenyns, Brit. Vert. p. 448.

Lota. *Generic Characters.*—In addition to the elongated body, with two dorsal fins and one anal fin, possessed by the species of *Merlucius* last described, may be added, chin with one or more barbules.

The Ling is a very valuable species, scarcely less so than the Coalfish or the Cod. Large quantities are taken among the Western Islands, in the Orkneys, and on the Yorkshire coast; in Cornwall, and the Scilly Islands; and may be traced nearly all round the Irish coast. The fishing for them is by hand-lines and long-lines; and besides a portion that is consumed fresh, the fish are split from head to tail, cleaned, salted in brine, washed, and dried: but the demand generally falls short of the quantity cured, and the hardy fishermen are but poorly requited. The ports of Spain are the markets supplied; and so valuable an article of commerce was Ling considered formerly, that an act for regulating the price of

Ling, Cod, &c. was passed as early as the reign of Edward the Third.

The air-bladders, popularly called Sounds, are prepared separately, and, with those of the Codfish, are sold pickled. The roes, which are of large size, are also used as food, or, preserved in brine, are sold to be employed to attract fish. Another produce of the Ling is the oil extracted from the liver, which is used by the poor to supply the cottage lamp; and as a medicine, Mr. Couch says, which those who have been able to overcome the repugnance arising from its nauseous smell and taste, have found effectual in severe cases of rheumatism, when taken in small beer in doses of from half an ounce to an ounce and a half. Formerly from fifty to sixty gallons of this oil, and that from the liver of the Codfish, were dispensed in one large establishment for this purpose, and it was found to act best when the perspiration was increased. The exudation from the skin of those to whom it was administered always became strongly tainted with it.*

In Zetland, the principal fishing for Ling is from May to August. On the Yorkshire coast the young are called Drizzles. In Cornwall they are caught in January and February, and their favourite haunts are about the margins of the rocky valleys of the ocean. The Ling is exceedingly prolific, and of most voracious appetite, feeding on young fish, not sparing anything that has life, and the prey is swallowed whole, so that no great art is required to catch it. It is tenacious of life, and survives great injury. "I once," says Mr. Couch, "saw a Ling that had swallowed the usual large hook, shaft foremost, of which the point had fixed in the stomach, and as the line drew it, it turned round, entered the opposite side of the stomach, and fastened the organ together in complicated folds; yet having escaped by breaking the line, it survived to swallow another hook and be taken several days after."

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* Memoirs of the Literary and Philosophical Society of Manchester, vol. iii.; and Dr. Bardsley's Medical Reports, 8vo. 1807, p. 18.

The most usual length of the Ling is from three to four feet; Pennant mentions having heard of one which measured seven feet; and Mr. Couch has known them weigh seventy pounds.

Not having an opportunity of describing from a specimen, I copy, by permission, the description of the Rev. Mr. Jenyns, as given in his Manual of the British Vertebrata, page 458, species 133.

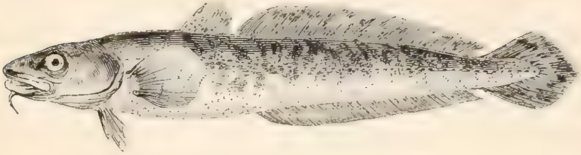
" Body slender, more elongated than that of the Hake; roundish: head flat: gape large: lower jaw shorter than the upper, with a single barbule at its extremity: teeth in the upper jaw small, and very numerous; those in the lower jaw longer and larger, forming but a single row: lateral line straight: scales small, firmly adhering to the skin: two dorsal fins of equal height; the first short, commencing near the head, not pointed as in the Hake, but with most of the rays even; second long, immediately behind the first, reaching nearly to the caudal; the posterior portion the most elevated: vent in a line with the eighth or ninth ray of the second dorsal fin: anal fin immediately behind it, long, resembling the second dorsal fin, and terminating on the same line with it: caudal rounded at the extremity.

" The fin-rays are—

D. 15. 65. : P. 15 : V. 6 : A. 97 : C. 39.

" The back and sides grey, inclining to olive; sometimes cinereous, without the olivaceous tinge; belly silvery: ventrals white; dorsal and anal edged with white; caudal marked near the end with a transverse black bar; the extreme tip white."

SUBBRACHIAL MALACOPTERYGII. *GADIDÆ.*



THE BURBOT.

EELPOUT. BURBOLT.

Lota vulgaris, Burbot, Jenyns, Man. Brit. Vert. p. 448, sp. 134.
,, ,, Cuvier, Règne An. t. ii. p. 334.
,, ,, Willughby, 125.
Gadus lota, Linnæus. Bloch, pt. ii. pl. 70.
,, ,, *Burbot,* Penn. Brit. Zool. p. 265.
,, ,, ,, Don. Brit. Fish. pl. 92.
Molva ,, ,, Flem. Brit. An. p. 192, sp. 83.

The Burbot is the only British species of this numerous family of fishes that lives permanently in fresh water, and prefers in this country slow running rivers; but is neither so generally known, nor so much esteemed and encouraged, as from the goodness of its flesh it deserves. It is said to be found in various parts of the North of Europe, Siberia, Asia, and India. In this country it is rather local. It occurs in the Cam, and in some of the rivers of Norfolk and Lincolnshire. The Trent produces it, and Nottingham market is occasionally supplied with examples for sale. The Tame is said to contain the Burbot, and so also do several rivers in the counties of Yorkshire and Durham; as the Ouse, the

Esk, the Skern, near Mainsforth, which afterwards runs into the Tees near Croft Bridge, and the Derwent.

The Burbot is not unlike the Eel in some of its habits, concealing itself under stones, waiting and watching for its prey, consisting of aquatic insects and young fish, under arches and near eddies, into which such small and weak animals are likely to be brought by the current of the water. It feeds principally during the night; and, like the Eel, is most frequently caught by trimmers and night-lines.

The Burbot is sometimes called Coney-fish, from its habit of lurking and hiding itself in holes like a rabbit.

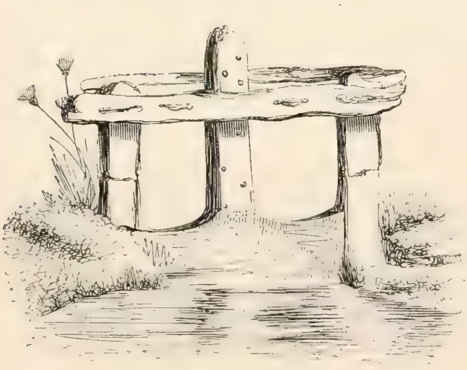
It spawns in February or March; is very tenacious of life, and is said to have lived a considerable time in a damp and cold situation, fed on small fishes and raw meat. In this country it has been known to attain the weight of four pounds and a half; but a more common size is about two pounds' weight. Pennant mentions one taken in the Trent which weighed eight pounds. In the Lake of Geneva, into which it is stated the Burbot was introduced from Neufchatel, it has been taken of seven pounds' weight. The flesh is white, firm, and of good flavour, by some considered superior to that of the Eel; and as the Burbot is in its nature extremely hardy, few difficulties present themselves in the way of their increase in quantity, while the value of the fish would amply repay the trouble or the cost of the experiment. It would probably thrive well and multiply in large lakes.

Length from one to two feet: the head depressed, smooth; jaws equal; chin with one barbule; the gape large, with small teeth above and below; eyes of moderate size; gill-opening large: the length of the head compared to that of the body as one to four: the form of the body cylindrical, compressed posteriorly. The first dorsal fin is small and rounded; the second elongated, reaching nearly to the tail;

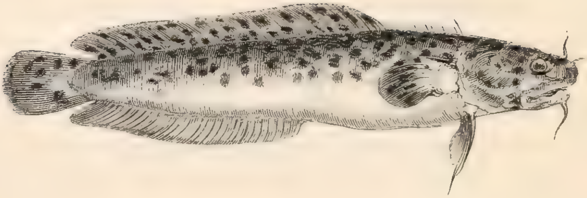
both dorsal fins nearly uniform in height: ventral fins placed very forward, narrow, and pointed; the pectoral fins large and rounded; the anal fin begins on a line behind the commencement of the second dorsal fin, but ends very nearly on the same plane: the tail oval, and slightly pointed. The fin-rays in number are—

D. 14. 68. : P. 20 : V. 6 : A. 67 : C. 36.

The colour of the body yellowish brown, clouded and spotted with darker brown, and covered with a mucous secretion; the under parts lighter: the lateral line indistinct and straight; scales small; the fins partaking of the colour of the part of the body from which they emanate, those of the lower surface being much the lightest.



SUBBRACHIAL
MALACOPTERYGII. GADIDÆ.



THE THREE-BEARDED ROCKLING.

SEA LOCHE.—WHISTLE-FISH.

Motella vulgaris,	Cuvier, Règne An. t. ii. p. 334.
,, *tricirrata,*	Nilsson, p. 48.
,, ,,	*Three-Bearded Rockling,* Jenyns, Man. Brit. Vert. p. 449, sp. 135.
,, ,,	Willughby, p. 121, H. 4, fig. 4.
Mustela marina,	*Rockling,* Ray, Syn. p. 164, sp. 9, fig. 9.
Gadus tricirratus,	Bloch, pt. v. pl. 165.
,, *mustela,*	*Three-Bearded Cod,* Penn. Brit. Zool. vol. iii. p. 267, pl. 36.
,, ,,	*Rockling,* Don. Brit. Fish. pl. 2.
,, *tricirratus,*	*Three-Bearded Gade,* Flem. Brit. An. p. 193, sp. 86.

Motella. *Generic Characters.*—Body elongated, cylindrical, compressed posteriorly; the first dorsal fin very slightly elevated, delicate in structure, scarcely perceptible; second dorsal and anal fins long, continued nearly to the base of the tail.

The Three-Bearded Rockling, included by the Rev. Mr. Jago in his Catalogue of the rarer Fishes of Cornwall, and published by Ray, with a figure, at the end of his Synopsis, though not uncommon on the Devonshire and Cornish coasts, as noticed by Colonel Montagu and Mr. Couch, is more rare on our shores generally than the Five-

Bearded Rockling, of which by some it has been considered only as a variety. It is also rare on the east coast of Scotland. It frequents rocky ground that is well furnished with sea-weed, among which it threads its way with great ease and rapidity. Besides the localities mentioned, it has been taken also at Weymouth, in Belfast Bay, and in the vicinity of Carlisle, probably in the Solway Frith. The individual figured by Willughby, whose early representation of this fish is very good, was obtained by him at Chester.

Mr. Thompson says it is generally distributed on the coast of Ireland.

Of its habits, Mr. Couch says, " It keeps in shallow water, feeds on aquatic insects, and will take a bait; but it is not commonly used as food, because it smells unpleasantly in the course of a few hours. It is not easy to explain the use of the fringed membrane behind the head and before the dorsal fin; it has nothing in common with the fins; but when the fish is lying perfectly still, and all the fins are at rest, this is often in rapid motion. The barbules on the upper jaw are always extended in front, and probably serve the same purposes as the antennæ in insects."

Bloch says that it spawns in autumn; but other observers consider that it deposits its spawn in winter, like most of, if not all, those of the same family.

Pennant, in his account of the Five-Bearded Rockling, says, " The Cornish fishermen are said to whistle, and make use of the words *bod*, *bod*, *vean*, when they are desirous of taking this fish, as if by that they facilitated the capture, in the same manner as the Sicilian fishermen repeat their *Mamassu di pajanu*, &c. when they are in pursuit of the Swordfish." But this name of Whistle-fish was, according to Jago's Catalogue, attached to the Rockling with three barbules only, and even among them was but occasionally applied to the larger specimens. Pennant, it will be observed, speaks of the cause of the application of the name of Whistle-fish on the authority of others; and on inquiry, I find that the custom of whistling when fishing is neither practised nor known to the Cornish fishermen of the present day, and, in fact, that this fish is of too little value to be an object of any solicitude. I believe, indeed, that while preserving the sound of the name, the term has been changed, and a very different word substituted, and that for Whistle-fish we ought to read Weasel-fish. Both the Three and the Five Bearded Rocklings were called *mustela* from the days of Pliny to those of Rondeletius, and thence to the present time.

A specimen fourteen inches long, and beautifully spotted, was presented to the Zoological Society in 1832. The finest examples of this species I have seen were two given me in December 1834, by Dr. Thackeray, the Provost of King's College, Cambridge, from the largest of which, measuring seventeen inches in length, the wood-engraving was executed, and the following description taken.

The length of the head compared to the length of the body alone, without the caudal rays, is as one to four; the depth of the body equal to the length of the head: the first dorsal fin delicate in structure; the first ray elongated, the rest hair-like: the second dorsal fin commencing immediately behind the end of the first, and reaching along the back to the tail, but ending a little short of the base of the caudal rays: ventral fins with the first two rays elongated, the second the most so, the two disunited; the other five rays nearly equal, united, and short: pectoral fins rather large and rounded: the vent half-way between the point of the chin and the end of the fleshy portion of the tail; the anal fin commences immediately behind it, is one-fourth less in length than the second dorsal, and ends on the same plane with it: the tail moderate in size, and rounded at the end.

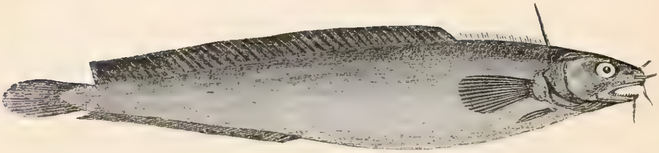
The fin-rays in number are—

2nd D. 55 : P. 20 : V. 7 : A. 49 : C. 18.

The head is depressed; the mouth wide: the jaws nearly equal, but when separated, the lower jaw is the longest, with one barbule at the chin; a mixture of small and large teeth in each jaw; the upper jaw with one barbule on each side the middle, between the lip and the nostril; inner part of the upper lip crenate: the irides golden yellow; the anterior portion of the body of the fish cylindrical, or slightly depressed; the tail compressed: the general colour of the body and head is a rich yellow brown, spotted on the top of the head, along the back, the pectoral, dorsal, and caudal fins, with rich chestnut brown; the lower part of the sides, the ventral and anal fins, pale yellow brown, approaching to white, and without spots.

Young fish of this species are of a uniform brown colour until they have acquired six or seven inches in length; in this condition they are the *Mustela alia* of Ray.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE FOUR-BEARDED ROCKLING.

Motella cimbria, The Four-bearded Rockling,	Parnell, Wern. Mem. vol. vii. p. 449, pl. 44.
Gadus cimbrius,	Linnæus, Syst. Nat. p. 440, sp. 16.
,, ,,	Retz, Faun. Suec. p. 323.
Enchelyopus cimbricus,	Schneider, Syst. Ichth. p. 50, sp. 1, tab. 9.
Motella cimbrica,	Nilsson, Prod. Ichth. Scand. p. 48, sp. 2.

This species of *Motella*, first described by Linnæus, is included by Dr. Parnell in his description of the Fishes of the Forth, a specimen, fourteen inches in length, having been brought to him by a Newhaven fisherman, who had caught it a little to the east of Inchkeith on a Haddock line baited with muscles. It is a species perfectly distinct from the Three or the Five-bearded Rockling, so much more common on various parts of the coast, and may at once be distinguished from either by the greater length of the filament, which is placed in advance of the almost obsolete first dorsal fin. This filament in a fish of nine inches long, measures one inch and seven-eighths; and in another fish of ten inches and a half in length, measures two inches and a quarter, as I find from portions of two specimens sent me by Mr. Euing of Glasgow, to whom I am indebted for the opportunity of making known the new species of Smelt. These two specimens of the Four-bearded Rockling were taken near Rothsay, and in reference to them Mr. Euing's letters contain the following remarks:—"I have never met with the Three or the Five-bearded Rockling, but small specimens of that with four cirri are frequently brought in on the long lines from deep water. It is, indeed, by no means a very rare fish with us, and I have seen it at almost every visit to the coast since 1827, the year in which I first observed it."

I have since received two preserved specimens from Dr. Edward Clarke, who obtained several examples from the Frith of Forth while he was residing in Edinburgh; he is now settled at Hartlepool, and Ichthyology is likely to be greatly assisted by his observation and exertions.

This fish is rare in the Baltic, but is not uncommon on the southern coast of Sweden; it is found also among the islands of the Catigat, on the west coast of Norway, and in the Atlantic.

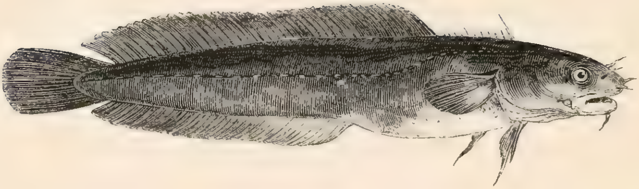
Dr. Parnell says, "on dissecting the specimen, I found the stomach filled with shrimps and small crabs. The cæcal appendages were few in number; the roe was large; the ova small and numerous, and apparently in a fit state to be deposited. It is probable that the habits of this fish are similar to those of the other species, but from its rarity it is difficult to determine."

Description by Dr. Parnell, from a specimen fourteen inches in length: "Form closely resembling that of the Five-bearded Rockling, but the length of the head somewhat greater compared to that of the body. The body elongated, rounded in front, compressed behind, tapering from the vent to the caudal extremity; greatest depth less than the length of the head. Head one-sixth of the entire length, caudal fin included, slightly depressed; snout blunt, projecting considerably beyond the under jaw; eye large, of an oval form, placed high up, and about its own length from the point of the nose; operculum rounded, oblique; gill-opening large; gape wide; maxillary extending in a line with the posterior margin of the orbit; teeth sharp and fine, forming two rows in the under jaw, and five rows in the upper; a few are also placed in a cluster on the anterior part of the vomer; barbules four, one a little in front of each nostril, one at the extremity of the upper lip, and one on the chin; tongue fleshy, smooth, and without teeth. Fins:—the first dorsal fin obsolete, scarcely discernible, commencing over the operculum, and terminating a little in front of the second dorsal, composed of a number of short, fine, capillary rays, of which the first is by far the largest; second dorsal taking its origin in a line over the ends of the pectorals, and terminating a little in advance of the caudal; anal fin commencing in a line under the twelfth ray of the second dorsal, and ending under the last ray but three of the same fin, in form similar to the second dorsal, but the rays scarcely more than one half the length; the first ray simple, the rest branched; caudal rounded at the extremity, the length of the middle rays equalling the space between the first and the twelfth rays of the anal, the lateral rays simple; ventral fins jugular, the second rays the longest, about two-thirds the length of the pectorals; the pectoral fins rounded at the extremities, equalling the length of the caudal; the first rays stout and simple, the rest branched. The fin-rays in number are,—

1st D. 50 : 2nd D. 50 : P. 16 : V. 5 : A. 43 : C. 20. Vert. 52.

“ Scales small, smooth, and adherent, covering the head, body, and membranes of the dorsal, caudal, and anal fins; lateral line formed by a number of oval depressions, placed at intervals from each other, commencing over the operculum, taking a bend under the ninth, tenth, and eleventh rays of the second dorsal fin, from thence running straight to the middle ray of the caudal. Colours:—Back and sides of a greyish brown; belly dirty white; second dorsal fin lighter in colour at the edge; pectorals, caudal, and lower part of the dorsal, dark brown, approaching to black; anal and ventrals dusky."

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE FIVE-BEARDED ROCKLING.

Motella quinquecirrata,	Cuvier, Règne An. t. ii. p. 334, *note.*
,, *mustela,*	*Five-Bearded Rockling,* Jenyns, Man. Brit. Vert. p. 450, sp. 136.
Mustela vulgaris,	Willughby, p. 121.
Gadus mustela,	Linnæus.
,, ,,	*Five-Bearded Cod,* Penn. Brit. Zool. vol. iii. p. 268, pl. 36.
,, ,,	,, Don. Brit. Fish. pl. 14.
,, ,,	,, *Gade,* Flem. Brit. An. p. 193, sp. 85.

I have found the Five-Bearded Rockling, when of small size, a very common fish on the Kentish coast in autumn, left by the retiring tide, in small pools among the rocks, and generally lying concealed under the tufts of sea-weed that hang over the edges of the stones into the water. I have observed this fish as far to the westward as Portland Island. Colonel Montagu considered it more rare in Devonshire than the species with three barbules at the mouth, just described: Mr. Couch observes it on the Cornish shore: it is generally distributed in Ireland; and Mr. Low says it is common in Orkney, where it is found under stones among sea-weed, but seldom exceeding nine or ten inches in length. Pennant says it attains the length of eighteen or nineteen inches. It spawns in the winter, and feeds principally on small thin-shelled crustacea and young fishes. Mr. Low says, "They are reckoned pretty good eating, but are never got in any quantity; never caught at a hook: the only method of getting them is by shifting the stones at low water, when they are to be found with the Blennies."

Dr. Johnston says it is not uncommon at Berwick, and Dr. Parnell finds it in the Forth: the young are about two inches long in July.

In its habits it closely resembles the Three-Bearded Rockling, and several naturalists consider them only as varieties of the same species. Professor Nilsson regards them as distinct, and follows Linnæus in considering a fish with four barbules also as a distinct species.

The length of the head compared to the length of the body alone, is as one to four; the depth of the body less than the length of the head: the shape of the body less cylindrical than that of the Three-Bearded, and the nose more pointed; the position and elevation of the fins similar to those of the fishes last described, but the first ray of the first dorsal fin is longer and more conspicuous, and the vent is nearer the head than in those species, being less than half the distance from the nose to the end of the fleshy portion of the tail. The fin-rays in number are—

2nd D. 52 : P. 14 : V. 6 : A. 40 : C. 20.

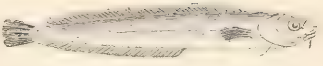
The body compressed; the head depressed; the mouth rather small, with a band of small teeth in each jaw, and a patch of similar teeth at the anterior part of the roof of the mouth; the under jaw the shortest, with a single barbule at the chin; the upper lip plain, without crenation, with two small barbules near the point of the nose, and two others, as long again, about as much before and within the nostrils as the nostrils are before and within the eyes. The eyes small, and placed near the nose. The colour of the upper part of the head, back, and sides, uniform dark brown; lower part of the sides lighter brown; under surface of the lower jaw, the ventral fins, and the belly to the vent, white; the other fins dusky brown: the course of the lateral line distinctly marked by a series of short, slender white streaks, as shown in the wood engraving.

I have been favoured by Dr. Richardson with the following description of the appearance of a fine example of this species:—General colour of the body pale bronze, approaching to that of jeweller's gold, with streaks of purer gold colour above the lateral line in the direction of the ribs. The upper parts of the head and the gill-covers yellowish brown, blended on the cheeks with the bronze. The fins are also of a brownish orange or bronze colour, but without the metallic lustre, and their margins are blood red; the red tinge is more general on the pectorals; the irides silvery, the pupils bluish black.

The three species last described have been called *mustela* by different authors. Linnæus attached this term to the species with five barbules: Cuvier, in the *Règne Animal*, identifies the Three-Bearded Rockling with this same word. As the number of barbules appear to be constant in each, a reference to the number in the specific name is, perhaps, the least objectionable. Linnæus, and other authors to the present time, continue, as before stated, to consider the northern species with four barbules as distinct from both, and there is no doubt that they are all three good species.

SUBBRACHIAL
MALACOPTERYGII.

GADIDÆ.



THE MACKEREL MIDGE.

Motella glauca, Mackerel Midge, JENYNS, Man. Brit. Vert. p. 451, sp. 137.
Ciliata ,, ,, ,, COUCH, Zool. Journ. vol. i. p. 132.
,, ,, ,, ,, ,, Mag. Nat. Hist. vol. v. p. 15 and 16, fig. 2, and p. 741.

MR. COUCH's MS. account of this beautiful little fish is as follows:—"It is about one inch and a quarter in length, moderately elongated; head obtuse, compressed: upper jaw the longest, with four straight barbules; the under jaw with one barbule; teeth in both jaws: gill membrane with seven rays; eyes large and bright; a fringed membrane in a depression behind the head; pectoral and ventral fins rather large for the size of the fish; dorsal and anal fins single, and reaching near to the tail; scales deciduous; colour on the back bluish green; belly and fins silvery. This seems to be one of the species spoken of by the older naturalists under the name of *apua;* and which, from their minute size, and the multitudes in which they sometimes appeared, they judged to be produced by spontaneous generation from the froth of the sea, or the putrefaction of marine substances. The name I have assigned to it is that in use among our fishermen, and is descriptive of its colour and very minute size, for it is the smallest fish with which I am acquainted."

“ This fish is gregarious and migratory, never making its appearance before May, after which it is abundant from the edge of the shore to every part of the Channel. Its winter station is probably deep in the water; but in summer it keeps near the surface, and seeks the shelter of everything it finds floating;—a circumstance that often leads to its destruction, for it is frequently hauled on board boats among the corks of nets, or with the line, or floating weeds; and in a storm they are often thrown into boats through the breaking of the sea,—a circumstance which shows that at such seasons they must be on the crest of the wave.”

“ This fish dies instantly on being taken out of the water.”

Part of a letter received from Mr. Couch in May 1840 is to the following effect:—“ I yesterday had an opportunity of observing the actions of a little company of Mackerel Midges that had been left by the tide in a large pool. Sometimes they gamboled about, keeping the body permanently bent at nearly a right angle, and moving the tail with great rapidity; at other times they kept under the shelter of a piece of seaweed, or other floating substance, and, passing across it repeatedly, seemed to delight in rubbing their backs against it.”

This small fish, with much the appearance of being the young of a larger species, and closely allied in form to the Five-Bearded Rockling, presents in its economy some of the attributes of a species. Unlike the fish last described, which is very tenacious of life, this little fish, it is said, dies instantly on being taken out of the water: it does not appear every summer, as might be expected if it was the young of so common and local a species as the Five-Bearded Rockling; and although present, as it is frequently said to be, during the greater part of the summer, when fry grow most rapidly, no increase is observed in its size.

THE SILVERY GADE.

Motella argenteola, YARRELL.
Gadus argenteolus, Silvery Gade, MONTAGU, Mem. Wern. Soc. vol. ii. pt. 2, p. 449.

THE following is Colonel Montagu's account of this small fish:—" There is a small species of *Gadus*, which is occasionally found on the western coast, that is nearly allied to the Three-Bearded Cod (Rockling) in most particulars; but the shape of the head and the colour are essentially different. It has very much the appearance of the fry of some larger species, and might have been suspected to be the young of the Ling, had it not been for a little difference in the first dorsal fin, and the two cirri which this has before the nostrils. If a fourth cirrus could have been discovered, suspicions would have arisen whether it might not have been the *cimbrius* of Gmelin. Its essential characters may stand thus:—

" With two dorsal fins, the anterior very obscure, except the first ray, which is much the longest: cirri three, two before the nostrils, and one on the chin: upper jaw longest; back bluish green; sides and belly silvery.

" The head is obtuse; eyes lateral, irides silvery: all the fins are of a pale colour, and the whole fish is of a silvery resplendence, except the back, which is blue, changeable to dark green: the pectoral fin is rounded with sixteen or eighteen rays; ventral, six or seven, the middle ray considerably the longest, and placed much before the pectoral: first dorsal fin commences above the gills, and the rays are very minute and obscure, the first excepted, but more than thirty have been counted; the second dorsal commences close to the other, in a line with the end of the pectoral, and terminates close to the caudal; the rays are innumerable: the anal fin begins immediately behind the vent, and terminates even with the dorsal; the caudal fin is nearly even at the end. Length about two inches.

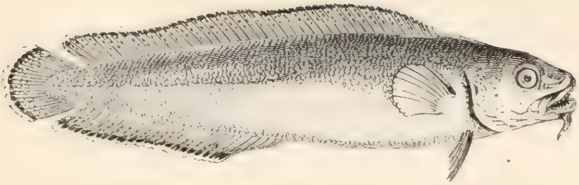
"I first noticed many of these fishes thrown upon the shore in the south of Devonshire, in the summer of 1808, and have taken two or three since. The fishermen called it Whitebait, but I afterwards found they had mistaken it for the fry of Herring and Pilchard, which indiscriminately go by that name, and are sold together in some places under the name of Herring-Sprat.

"The Three-Bearded Cod (Rockling) is a very common species on the western coast, and which I have taken of all sizes, from the most minute to its full growth of sixteen or seventeen inches, and never observed it to vary in colour, except as it grows large it becomes more rufous and throws out spots, which is never observed till it exceeds six or seven inches, but is invariably rufous brown in its infant state."

It is worthy of remark, that this little fish, representing in miniature the Three-Bearded Rockling, offers an instance perfectly analogous to the representation in an equally diminutive size of the five-bearded species, by Mr. Couch's recent discovery of the Mackerel Midge.

SUBBRACHIAL
MALACOPTERYGII.

GADIDÆ.



THE TORSK, OR TUSK.

Brosmius vulgaris,	Cuvier, Règne An. t. ii. p. 334.	
Brosmus ,,	*Common Tusk,*	Flem. Brit. An. p. 194, sp. 90.
,, ,,	*Torsk,*	Jenyns, Brit. Vert. p. 452.
Gadus brosme,	,,	Penn. Brit. Zool. vol. iii. p. 269, pl. 37.
,, ,,	*Scotch Torsk,*	Don. Brit. Fish. pl. 70.
,, ,,	Nilsson, Prod. p. 47, sp. 14.	

Brosmius. *Generic Characters.*—Body elongated; a single dorsal fin, extending the whole length of the back; one barbule at the chin; ventral fins fleshy.

The Torsk, or Tusk, is a northern species, which is only occasionally caught in the Forth, and is then brought to the Edinburgh market. It is found more frequently in the Orkney Islands, and swarms among those of Shetland, where it makes a very considerable article in their fish trade. It is caught with lines and hooks when fishing for Ling and Cod, and is salted and dried in the same manner. When eaten fresh, it is very firm and rather tough; which makes most people prefer it dry. It is one of the best fishes when cured, swells much in boiling, and parts into very thick flakes. I observed three examples of this fish, each about sixteen inches in length, in the London market, during the month of January 1831. These were brought from the North in the lobster-boats. The length assigned to this species by M. Nilsson is from eighteen inches to two feet, rarely three feet. Mr. Low says the largest he had heard of was three feet and a half. Mr. Donovan's specimen, which was brought alive to London in the well of a fishing-boat, measured twenty-five inches.

But little being known in the South of the habits of this fish, an abridgment of Faber's account of it may be interesting.

" A northern fish, scarcely occurring below 60° or above 73°; not migrating regularly, and therefore rarely seen by the ichthyologists of the South. Plentiful on the coasts of Norway as far as Finmark, of the Faroë Islands, and the west and south coasts of Iceland; rare on the north and east coasts of Iceland. It must be uncommon in Greenland, as Fabricius only knew it from the report of the natives. Just touches the most northern point of Denmark, at Skagen in Jutland, where it is sometimes taken; not at all in the south. Approaches the land early in the year in shoals, that of Iceland in January; remains there in company with the Five-Bearded, and goes away again late in summer. Lives in deep water, and is therefore seldom taken, even when it is most abundant. Prefers a rocky bottom, on which sea-weeds grow. Never found anything in its stomach; and this has probably given rise to the saying, that it lives on the juice of sea-weeds. Spawns in April and May among the *fuci* along the coast. Is rarely taken with the Cod hooks, more frequently at the smaller lines. Sometimes taken by the Norwegian fishermen among the Holibuts. It must have less power of resisting the violence of the sea than its congeners, as it is thrown up dead in incredible numbers on the coasts of the Faroë Islands and the south coast of Iceland after a storm. Its flesh is hard, but well flavoured. In Iceland seldom dried, but eaten fresh. Jan Olsen says that the fresh flesh is badly tasted, but when dried it is the best food. In Norway it is treated like the Stockfish, but forms no branch of merchandise. The hard roe, according to Pontoppidan, has a good flavour. Its enemies are the larger species of Cod. It is much infested by a worm which forms a *nidus* in its skin, and produces rounded swellings.

Dr. Storer says that a fish which he believes to be the same as our Torsk is not uncommonly seen in the Boston market in spring, but that in winter it is more rare. It is taken with the hook when fishing for deep-water Cod.

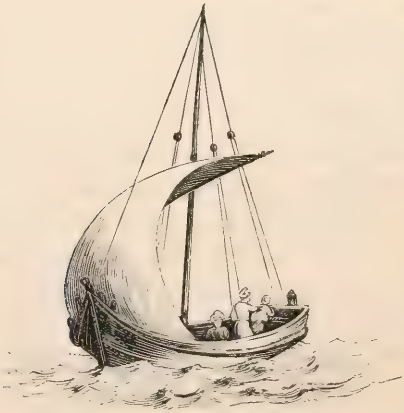
The description of this fish by Mr. Low is here adopted, with slight modification. The measurements of the specimen from which this description was taken were the following:—"The whole length twenty inches and a half: the greatest breadth four and a half, which was taken at the end of the pectoral fin; at the vent four inches; something more than half-way from the vent to the tail, two inches; at the tail, one inch and a quarter: the length of the head four inches; from the point of the nose to the commencement of the dorsal fin, six inches; length of the dorsal fin thirteen inches; from the point of the lower jaw to the vent, eleven inches; length of the anal fin, eight inches; tail something more than two inches."

"The head small in proportion to the fish, with a single barbule under the chin: the upper jaw very little longer than the lower; in the jaws there are great numbers of very small teeth, and in the roof of the mouth a rough or toothed bone, much in the shape of a horse-shoe; a pretty broad furrow runs from the nape to the commencement of the dorsal fin, which runs the whole length of the back to within about an inch of the tail; the tail is rounded; the anal fin begins at the vent and ends at the tail, but is not joined with it; the rays of the dorsal and anal fins are numerous, but the softness of these and the thickness of the investing skin hinder them from being counted with exactness: the edges of the dorsal, anal fin, and tail, are white; the rest dusky: the pectoral fins are rounded, broad, and of a brown colour; the ventrals small, thick, and fleshy, ending in points; the body to the vent is roundish; the belly from the throat growing suddenly very prominent, continuing so to the vent, where it becomes smaller to the tail; behind the vent the body is pretty much compressed: the colour of the head is dusky; the back and sides yellow, which becoming lighter by degrees, is lost in the white of the belly; the lateral line is scarcely discernible, but runs nearer the back than the belly, till towards the middle of the fish, in its passage backwards, it curves a little downwards, and runs straight to the tail."

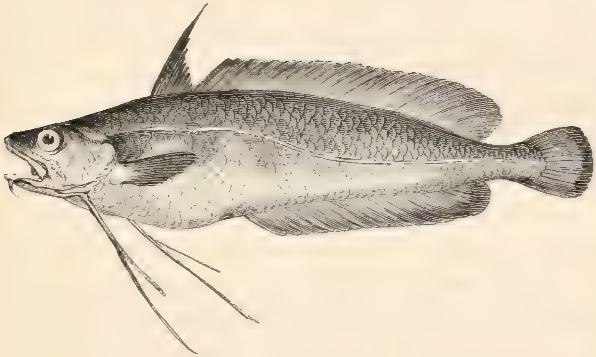
The fin-rays, according to Mr. Donovan, are—

D. 49 : P. 21 : V. 5 : A. 37 : C. 35.

The vignette represents a fishing-boat of Cadiz Bay.



SUBBRACHIAL MALACOPTERYGII. *GADIDÆ.*



THE GREAT FORKED BEARD.

FORKED HAKE. HAKE'S DAME, *Cornwall.*

Phycis furcatus,	*Common Fork Beard,*	Flem. Brit. An. p. 193, sp. 84.
,, ,,		Cuvier, Règne An. t. ii. p. 335.
Barbus major,	*Great Forked Beard,*	Ray, Syn. p. 163, fig. 7.
Blennius physis,	*Forked Hake,*	Penn. Brit. Zool. vol. iii. p. 259, pl. 35.
Phycis furcatus,	*Common Fork Beard,*	Jenyns, Brit. Vert. p. 452.

Phycis. *Generic Characters.*—Body elongated; two dorsal fins, the first short, the second long; ventral fins with a single ray only at the base, afterwards divided; chin with one barbule.

The Great Forked Beard was first discovered on the Cornish coast by Mr. Jago, and inserted by Ray, with a figure, in his Synopsis, as referred to. Pennant's fish was taken on the coast of Flintshire. A specimen appeared in Carlisle market in December 1833, which was caught near Bowness; communicated to me by T. C. Heysham, Esq.: and this fish has also occurred at St. Andrews in Scotland, as noticed in the sixth volume of the Memoirs of the Wernerian Natural History Society, page 569. It is obtained occasionally in Cornwall; Mr. Dillwyn has published a notice of one, measuring two feet in length, which was cast ashore in Oxwich Bay, and weighed four pounds; and Mr. William Thompson has noticed the occurrence of this fish in Ireland.

The figure here given is taken from a drawing by Mr. Couch, whose MS. contains the following notice of this species:—"The head flat on the top, compressed at the sides, small in proportion to the body: eyes large; nostrils in a depression before them: mouth wide: under jaw shortest; teeth in both fine; some larger teeth on the palate: a barb at the lower jaw: body compressed, slender towards the tail, which is small in proportion; belly tumid; lateral line elevated at first, afterwards low; body and head with scales: two dorsal fins, the first elevated and pointed; second dorsal and anal fins long, expanded, bound down towards the tail; the ventral fins simple rays, very long, divided or forked, one of the divisions longer than the other; a few spines before the anal fin; tail rounded, all the rays soft. Colour of the sides and back dusky brown; on the gill-covers sometimes greenish; fins dusky purple, except the ventrals; belly whitish.

"This fish grows to the length of two feet: in a specimen of this size the longest portion of the ventral ray was eight inches, the shortest five inches and a half.

"Hake's Dame is the name by which alone this fish is known to our fishermen. It is not uncommon in Cornwall; but I have never seen it except in winter, when it seems to come into shallow water to spawn. It takes a bait, and is used as food, but is not much esteemed."

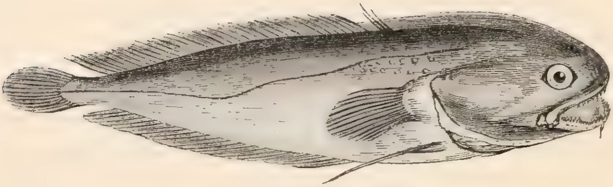
The number of fin-rays are—

1st D. 9 : 2nd D. 58 : P. 16 : V. 1 : A. 51 : C. 18.

It is desirable to notice the specific characters of this fish, in order to distinguish between it and a Mediterranean species of the same genus, which, according to Cuvier, is the true *Blennius phycis* of Linnæus, and not the British fish, as supposed by Pennant and others. The British fish has the first dorsal fin triangular, much higher than the second, the anterior rays produced; the ventral rays twice as long as the head. The Mediterranean fish, of which I possess a specimen, has the first dorsal fin low and rounded, very similar in character to that of the Burbot, as figured at page 267 of this volume, with the ventral rays much shorter. A description and figure of this fish is given by Willughby, page 205, pl. N. 12, fig. 3.

At the time of the publication of the first edition of this work, I had not seen a specimen of this fish. Since then I have received a very fine example sent me by T. C. Heysham, Esq. of Carlisle, from the west coast, where it has occurred lately in two or three instances: one was taken on the coast of the Solway Frith, near Whitehaven. Mr. Couch has very kindly sent me two examples of this species, one an adult specimen, the other a young fish only three inches long, which was fished up in the shell of a large pinna, from a depth of fifty fathoms, in July 1837.

SUBBRACHIAL
MALACOPTERYGII. *GADIDÆ.*



THE LESSER FORKED BEARD.

TRIFURCATED HAKE. TADPOLE FISH.

Raniceps trifurcatus,	*Trifurcated Hake,*	FLEM. Brit. An. p. 194, sp. 88.
,, *Jago,*	,, ,,	,, ,, ,, ,, 89.
,, ,,	CUVIER, Règne An. t. ii. p. 336.	
Barbus minor,	*Lesser Forked Beard,*	RAY, Syn. p. 164, sp. 8, fig. 8.
,, ,,	*Forked Hake,*	PENN. Brit. Zool. vol. iii. p. 261.
Batrachoides trifurcatus,	*Trifurcated Tadpole Fish,*	PENN. Brit. Zool. vol. iii. p. 272, pl. 38.
Raniceps trifurcatus,	*Tadpole Fish,*	JENYNS, Brit. Vert. p. 453.

RANICEPS. *Generic Characters.*—Head depressed, body compressed ; two dorsal fins, the first very small ; the second dorsal and the anal fins elongated ; ventral fins small, the first two rays lengthened and separated.

DR. GEORGE JOHNSTON, of Berwick, in his address to the members of the Berwickshire Naturalist's Club, read at the first anniversary meeting in September 1832,* when referring to the various species of fishes which had occurred to him during the previous twelvemonths, remarks at page 7 : " Of the Tadpole Fish, which is one of the rarest British species, and previously known only as an inhabitant of the shores of Cornwall, I had the pleasure of exhibiting to you a living specimen, which had been captured in Berwick Bay. When alive, and when recently dead, the body appeared everywhere smooth and even; but after having lain three days on a plate and become a little shrivelled, there appeared an obscure row of tubercles, running backwards from the pectoral fins,—and these pea-like tubercles could be more readily distinguished by drawing the finger over the skin. I would call attention to this fact, because the only good distinction between the ***Raniceps trifurcatus*** and ***R. Jago*** of Dr. Fleming is derived from the presence of these tubercles; in the former, the lateral line is said to be tuberculated above the pectoral fins, in the latter it is said to be smooth: but here we have a specimen which when alive exhibits the character of *Jago*,—when dead, that of the *trifurcatus;* and hence I am induced to think that both are the same animal, having the tubercles more or less prominent and obvious according to the leanness or other conditions of the body."

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* See also Mr. Loudon's Mag. Nat. Hist. vol. vi. page 11.

The difficulty of deciding the point without possessing a specimen, which the rarity of the fish rendered almost hopeless, probably induced Dr. Fleming to follow Pennant in giving both names a place in his History of British Animals. The description of Mr. Couch is quoted by Dr. Fleming as belonging to the Cornish fish and the Lesser Forked Beard of Jago; and Cuvier, in a note at the foot of page 336 of the second volume of the ***Règne Animal***, quotes the *Gadus trifurcatus* of Pennant as belonging to his genus ***Raniceps.***

The advantages of equal communication and assistance on this point from Mr. Couch and Dr. Johnston enable me to carry the comparison of the two fishes still further.

Mr. Couch has favoured me with a drawing and a description of a specimen taken in Cornwall. The description is already given by Dr. Fleming. Dr. Johnston has also furnished me with a coloured drawing, a penciled sketch, and a description. These compared together, these again compared with the double representations in the last two octavo editions of Pennant's British Zoology, and each with the figure of Jago's fish in Ray's Synopsis, will, I think, leave little doubt that all are intended to represent the same fish.

Sir William Jardine has reminded me that a tolerable figure of this fish occurs in Müller's *Zoologia Danica*, under the name of *Blennius raninus*. The figure here given is from Dr. Parnell's engraving in his History of the Fishes of the Frith of Forth.

Dr. Johnston's description is as follows:—

" The comparison implied in the name Tadpole Fish is very expressive of its general form and colour; for when alive it was entirely black, and the anterior parts are large and tumid, while the hinder are much compressed. The extreme length of our Berwickshire specimen was eleven inches; and its greatest circumference, which is immediately before the pectoral fins, was seven inches, whence it tapered rapidly to the tail. The head is very large, obtuse, and flattened on the crown, where there is a slight depression between the eyes, which are an inch distant from each other, lateral, prominent, round, and black. The mouth is wide; and under the chin there is a small conical barb or feeler: the lips are rounded and white; the inferior jaw armed with two close rows of sharp teeth, and the upper, which is moveable, with similar teeth, but more numerous, and not distinctly rowed. On the palate, behind the jaw, there is a semilunar cartilaginous prominence or tubercle roughened with small teeth; and the wide entrance into the œsophagus is guarded with four similar tubercles, but of a roundish figure, two above, and two smaller below. The branchial rays are few in number, and on the inner side of each of them there are two rows of minutely spinous tufts. The first dorsal fin is very minute, but is terminated by a rather long ray: the second dorsal fin commences just behind it, or one-third of the whole length from the head, and extends nearly to the tail; it is half an inch broad, equal throughout, the rays ending in free single points. The anal fin is like the dorsal: the pectorals are oblong wedge-shaped, one inch and a half long: the ventral fins are small, and their two anterior rays are very long, white, and detached; the foremost one-half the length of the second, which measures little less than two inches. Tail wedge-shaped. The scales are small, and lie close to the body: they have an oblong square form, marked with parallel lines or striæ, which on the exposed part of each scale run in a transverse, and on the covered parts in a longitudinal direction."

The numbers of the different fin-rays, according to Pennant are—

1st D. 3 : 2nd D. 62 : P. 23 : V. 6 : A. 59 : C. 36.

Mr. Couch says this fish is too rare for us to be much acquainted with its history. The only specimen he ever saw was taken with a line in rocky ground, in the month of April; at which time its roe was small. The remains of an echinus were in its intestines. Other examples have since occurred; it has been taken on the east and west coasts of Scotland, and once in Ireland off Donaghadee Harbour, as recorded by Mr. William Thompson. Dr. Parnell says it spawns in April, and feeds on small insects.

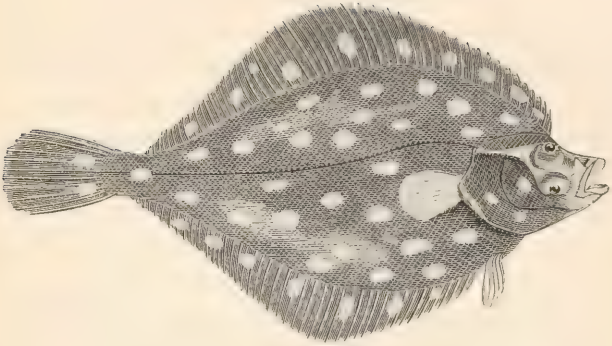
The following note appears at the end of Mr. Couch's account of this fish:—

" Mr. Jago, whose name occurs at the head of a list of fishes at the end of Ray's *Synopsis Piscium*, was a native of Cornwall, and a minister of the Church of England.

When Bishop Trelawney, so well known as one of the six bishops committed to the Tower by James the Second, endowed the Chapel of Ease at East Looe, and thereby obtained the consent of the Rector of St. Martin to name the curate, he appointed his friend Mr. Jago to the curacy; and the latter embraced the favourable opportunity thus placed within his reach to make collections for an intended History of Cornish Fishes, which, however, he never perfected. Never having been married, his MS. and drawings at his decease came into the possession of his friend Mr. Dyer, by whom they were delivered to Dr. Borlase, the author of the History of Cornwall.

SUBBRACHIAL
MALACOPTERYGII.

*PLEURONECTIDÆ.**



THE PLAICE.

Platessa vulgaris,	*Plaise,* Flem. Brit. An. p. 198, sp. 103.
,, ,,	Cuvier, Règne An. t. ii. p. 338.
,, ,,	*Plaise,* Willughby, p. 96, F. 4.
Pleuronectes platessa,	Linnæus. Bloch, pt. ii. pl. 42.
,, ,,	*Plaise,* Penn. Brit. Zool. vol. iii. p. 304.
,, ,,	,, Don. Brit. Fish. pl. 6.
Platessa vulgaris,	*Common Plaice,* Jenyns, Brit. Vert. p. 454.

Platessa. *Generic Characters.*—Body rhomboidal, depressed; both eyes on the right side of the head, one above the other; a row of teeth in each jaw, with others on the pharyngeal bones; dorsal fin commencing over the upper eye, that fin and the anal fin extending nearly the whole length of the body, but neither of them joined to the tail; branchiostegous rays 6.

The character and appearance of the various species of *Pleuronectidæ*, or Flatfish, as they are popularly called, are so peculiar and so unique among vertebrated animals as to claim particular notice.

The want of symmetry in the form of the head; both eyes placed on the same side, one higher than the other, frequently not in the same vertical line, and often unequal in size; the position of the mouth; the inequality of the two sides of the head, and the frequent want of uniformity in those fins that are in pairs, the pectoral and ventral fins of the under or white side being in some species smaller than those of the upper; and the whole of the colour of the fish confined to one side, while the other side remains perfectly white,—produce a grotesque appearance: yet a little consideration will prove that these various and seemingly obvious anomalies are perfectly in harmony with that station in nature which an animal bearing these attributes is appointed to fill.

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* The family of the Flounders, popularly called Flatfish.

As birds are seen to occupy very different situations, some obtaining their food on the ground, others on trees, and not a few at various degrees of elevation in the air, so are fishes destined to reside in different situations in the water: the Flatfishes and the various species of Skate are, by their depressed form of body, admirably adapted to inhabit the lowest position, and where they occupy the least space, among their kindred fishes.

Preferring sandy or muddy shores, and unprovided with swimming-bladders, their place is close to the ground, where, hiding their bodies horizontally in the loose soil at the bottom, with the head only slightly elevated, an eye on the under side of the head would be useless; but both eyes placed on the upper surface affords them an extensive range of view in those various directions in which they may either endeavour to find suitable food, or avoid dangerous enemies. Light, one great cause of colour, strikes on the upper surface only; the under surface, like that of most other fishes, remains perfectly colourless. Having little or no means of defence, had their colour been placed only above the lateral line on each side, in whatever position they moved, their piebald appearance would have rendered them conspicuous objects to all their enemies. When near the ground, they swim slowly, maintaining their horizontal position; and the smaller pectoral and ventral fins on the under side are advantageous where there is so much less room for their action, than with the larger fins that are above. When suddenly disturbed, they sometimes make a rapid shoot, changing their position from horizontal to vertical: if the observer happens to be opposite the white side, they may be seen to pass with the rapidity and flash of a meteor; but they soon sink down, resuming their previous motionless, horizontal position, and are then distinguished with difficulty, owing to their great similarity in colour to the surface on which they rest.

Though the appearance and situation of the eyes and mouth seem to indicate a degree of deformity, yet the head contains modifications of all the bones that are found in a symmetrically-formed head. The vent is situated very far forward between the ventral fins and the commencement of the anal fin; but the abdominal cavity, though circumscribed, extends backwards to a considerable distance, the intestine returning by a convolution.

Most of the Flatfishes are deservedly in great request as articles of food. The number of species diminishes as the degrees of northern latitude increase. In this country we have sixteen species; at the parallel of Jutland, Denmark, and the islands at the mouth of the Baltic, there are thirteen; on the coast of Norway they are reduced to ten species; at Iceland the number is but five, and at Greenland only three.

The Plaice is described and figured by Rondeletius, and was known to the older naturalists long before his time. It inhabits sandy banks and muddy grounds in the sea; and among the Orkney islands is caught by lines and hooks; but as it is not of large size there, it is not much sought after: it is common, however, in the Edinburgh market, where the small ones are called Fleuks. On the English coast the Plaice is taken in abundance generally wherever either lines or trawl-nets can be used; and in Ireland, this fish is recorded to be taken from the shores of the county of Cork on the south, round by the eastern coast to the county of Donegal on the north-west.

The Plaice spawns in February or March, and is considered to be in the finest condition for the table at the end of May. Diamond Plaice is a name attached to those which are caught at a particular fishing-station off the Sussex coast, which is called the Diamond ground. The fish are remarkable for the purity of the brown colour and the brilliancy of the spots.

Plaice feed on the soft-bodied animals generally, with young fish and small crustacea, and have been known to attain the weight of fifteen pounds; but one of seven or eight pounds' weight is considered a Plaice of large size. It is taken sometimes in almost incredible numbers. So great a glut of Plaice occurred once in Billingsgate market, that, although crowded with dealers, hundreds of bushels remained unsold. Great quantities of Plaice, averaging three pounds' weight each, were sold at one penny per dozen. One salesman, having in vain endeavoured to sell a hundred bushels at the rate of fifty Plaice for four-pence, left them with Mr. Goldham, the clerk of the market, requesting him to sell them for anything he could get. Unable to dispose of them otherwise, Mr. Goldham, by direction of the Lord Mayor, divided them among the poor.

In some parts of the North of Europe, where from the rocky nature of the soil the sea is remarkably transparent, Plaice and some other Flatfish of large size are taken by dropping down upon them, from a boat, a doubly-barbed short spear, heavily leaded to carry it with velocity to the bottom, with a line attached to it, by which the fish when transfixed is hauled up.

In East Friesland the Plaice has been transferred to fresh-water ponds, where it is established and thrives well.

Like other ground-fish, all the *Pleuronectidæ* are very tenacious of life.

The length of the head compared to the whole length of the head, body, and tail, is as two to nine; the depth of the solid part of the body, without including the dorsal or anal fins, rather more than one-third of the whole length; the form subrhomboidal; the mouth and teeth rather small; the upper eye the largest, and placed rather more backward than the lower eye, with a strong and prominent bony ridge between the orbits, and several tubercles forming a curved line from the posterior part of the ridge to the commencement of the lateral line: the preoperculum is in a vertical line over the origin of the ventral fin; the operculum terminates in an angle upon the base of the pectoral fin; the lateral line prominent, commencing at the upper margin of the operculum, arched over the pectoral fin, then straight along the middle of the fleshy portion of the tail, and extending over the membrane connecting the central caudal rays. The dorsal fin commences over the upper eye; the longest rays rather behind the middle of its whole length: the anal fin, preceded by a spine, begins in a line under the origin of the pectoral fin; the longest rays rather before the middle: both dorsal and anal fins end on the same plane, and short of the end of the fleshy portion of the tail, which, as well as the caudal rays, is narrow and elongated; the tail rounded.

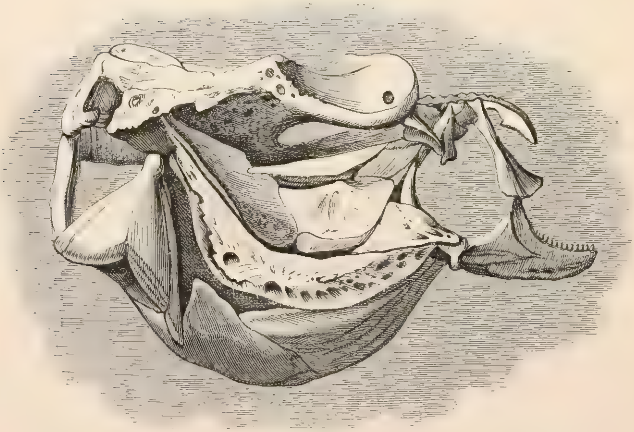
The fin-rays in number are—

D. 73 : P. 11 : V. 6 : A. 55 : C. 16.

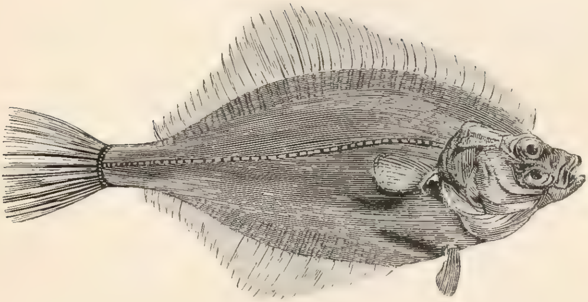
The body is smooth on both sides, the scales small; the colour of the upper or right side a rich brown, with a row of bright orange red spots along the dorsal and anal fins, and other spots of the same colour dispersed over the body; the under side entirely white. Young Plaice have frequently a dark spot in the centre of the red one.

The fishes of this first division of the *Pleuronectidæ* with the eyes and the colour on the right side of the body are further distinguished by the term *dextral* fishes.

The vignette represents the bones of the head in the genus *Platessa*.



SUBBRACHIAL
MALACOPTERYGII. *PLEURONECTIDÆ.*



THE FLOUNDER.

FLOOK, *Merret.*—MAYOCK FLEUKE, *Edinb.*—BUTT.

Platessa flesus,	*Flounder,*	Flem. Brit. An. p. 198, sp. 104.
,, ,,	*Le Flet,*	Cuvier, Règne An. t. ii. p. 339.
Pleuronectes fluviatilis,	*Fluke,*	Willughby, p. 97, F. 4.
,, *flesus,*	,,	Linnæus. Bloch, pt. ii. pl. 44 & 50.
,, ,,	*Flounder,*	Penn. Brit. Zool. vol. iii. p. 305.
,, ,,	,,	Don. Brit. Fish. pl. 94.
Platessa ,,	,,	Jenyns, Brit. Vert. p. 455.

The Flounder is one of the most common of the Flatfish, and is found in the sea and near the mouths of large rivers all round our coast, being more particularly abundant where the bottom is soft, whether of sand, clay, or mud. All the bays, creeks, and inlets of Orkney produce it, according to Mr. Low; and it is taken in abundance in different parts of Scotland, where it is called Fluke and Mayock Fleuke,—a term having reference to the flattened form of the fish. It is common at Berwick and Yarmouth, at which latter place it is called a Butt—a northern term; and those Flounders that are caught in the extensive backwaters behind Yarmouth, where there is a considerable deposit of mud, are in consequence so dark in colour as to be distinguished, from the lighter-coloured ones caught on the sands of the sea, by the name of Black Butts. This similarity in colour between certain fishes and the bottom upon which they are found has been already referred to as affording security to the defenceless from the attacks of their enemies, and exhibits a beautiful instance of the design employed for the preservation of species. In Sweden, according to Linnæus, this fish is called *Flundra*, from which our word Flounder is probably derived, and is said to refer to its manner of swimming when close to the ground.

The Flounder lives and thrives whether stationary in the sea, the brackish water, or the fresh water. In the Thames it is taken as high up as Teddington and Sunbury: Mr. Jesse mentions having seen the Flounder pursue Minnows with great eagerness into the shallows where the Mole runs into the Thames at Hampton Court. This species is caught in considerable quantities from Deptford to Richmond by Thames fishermen, who, with the assistance of an apprentice, use a net of a particular sort, called a tuck-net, or tuck-sean. One end of this net is fixed for a short time by an anchor or grapple, and its situation marked by a floating buoy; the boat is then rowed, or rather sculled, by the apprentice in a circle, the fisherman near the stern handing out and clearing the net: when the circle is completed and a space inclosed, the net is hauled in near the starting point in a direction across the fixed end.

Flounders ascend rivers generally. Colonel Montagu says they are found up the Avon within three miles of Bath. They have been successfully transferred to fresh-water ponds:

being long-lived out of water, the carriage from one place to another is a matter of very little difficulty. Along our southern shore the Flounder is very common ; and it occurs on the Irish coast from Cork up the eastern side to Antrim, and thence northward and westward to Donegal.

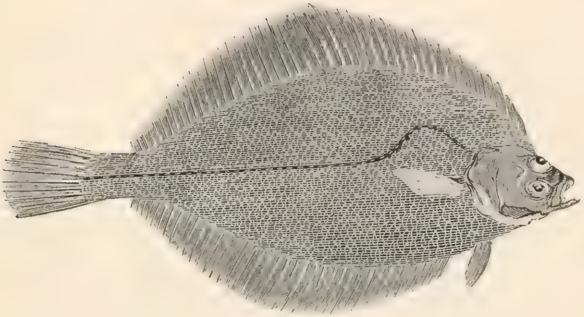
The Flounder feeds upon aquatic insects, worms, and small fishes, and has been known to acquire the weight of four pounds, but is not usually seen near so large. It spawns in February or March, and the young Flounders may be seen alive by the end of April. Varieties of the Flounder occur much more commonly than those of any other species of Flatfish. I have before me, while now writing, specimens without any colour on either side ; specimens coloured on both sides ; and specimens with both eyes and the whole of the colour on the left side instead of the right. Those without any dark colour on either side are albino varieties, through the transparent skins of which the colour of the blood-vessels and muscles has suggested the trivial names of *rosea* and *carnaria* to the authors who considered them species. The *Pl. passer*, figured by Bloch, pt. ii. pl. 50, is certainly only a reversed Flounder, having the eyes and the colour on the left side ;—a variety so common, that it is scarcely possible to examine a peck measure of Flounders without finding one or more reversed specimens. One of the most remarkable specific distinctions of the Flounder, the series of denticulated tubercles placed between the rays of the fins along the dorsal and abdominal lines, is distinctly figured in both Bloch's plates as quoted, pt. ii. plates 44 and 50.

The length of the head is to the whole length of the fish as one to four ; the greatest width of the body, without the fins, is to the whole length of the fish as one to three : the mouth small : the teeth in one row in each jaw, small and numerous ; the upper eye nearly over the lower ; the lateral line but very slightly curved over the pectoral fin, and marked with numerous rough stellated tubercles at its commencement, some more of which are arranged in two lines, one above, the other below the lateral line throughout its course: the body smooth; the scales small; the dorsal and abdominal lines armed with a series of denticulated tubercles, one in each space, between the rays, and alternating with them; the dorsal fin extends from the eye almost to the tail; the ventral fin is placed a little farther back than in the Plaice, under the margin of the operculum; the anal fin, preceded by a spine directed forwards, also commences farther back; both dorsal and anal fins terminate on the same plane; the fleshy portion of the tail narrow, its rays elongated, and almost square at the end. The fin-rays in number are—

D. 55 : P. 11 : V. 6 : A. 42 : C. 14.

The colour of this species is variable, the shades of brown depending on the nature of the ground from which the fish is taken, but generally mottled with darker brown; the fins light brown, occasionally varied with patches of darker brown, but generally lighter than the body. Examples sometimes occur with a few indistinct reddish spots on the upper surface; but the roughness of the lateral line in the Flounder, and its smoothness in the Plaice, is a distinguishing character in these two species, however similar they may happen to be in colour or size.

SUBBRACHIAL
MALACOPTERYGII. *PLEURONECTIDÆ.*



COMMON DAB.

SALTIE, AND SALT-WATER FLEUK, *Edinburgh.*

Platessa limanda,	*Dab,*	FLEM. Brit. An. 198, sp. 105.
,, ,,	*La Limande,*	CUVIER, Règne An. t. ii. pp. 339 & 340.
Passer asper,	*Dab,*	WILLUGHBY, p. 97, F. 4.
Pleuronectes limanda,	LINNÆUS.	BLOCH, pt. ii. pl. 46.
,, ,,	*Dab,*	PENN. Brit. Zool. vol. iii. p. 308.
,, ,,	,,	DON. Brit. Fish. pl. 44.
Platessa ,,	,,	JENYNS, Brit. Vert. p. 456.

THE DAB is common to all the sandy parts of the coast, and is usually caught along with Plaice and Flounder; but is immediately distinguished from either by its more uniform and lighter brown colour, its more curved lateral line, and the roughness of the scaly surface, from which latter circumstance it has been called in Latin, *limanda*, from *lima*, a file. Dr. Neill reports it as common in the market of Edinburgh, where it is called Saltie, or Salt-water Fleuk. I have received it from Berwick, and it is taken at Yarmouth. It is very common in the London market, and Colonel Montagu says it is caught along the Devonshire coast with the seine-net; many are also taken by trawling.

It occurs in Cornwall, and is recorded as found on several parts of the east coast of Ireland between Waterford and Belfast.

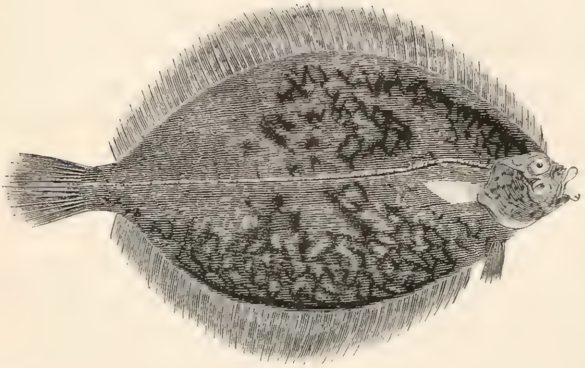
The Dab feeds on small fish, crustacea, and testacea, particularly *Pecten obsoletus*; and is in best condition for the table in February, March, and April. Its flesh is considered superior to that of the Plaice or Flounder; Cuvier says it is in higher estimation in Paris than the Flounder, because it bears carriage better. It spawns in May or June; inhabits deeper water generally than the Flounder; and on some parts of the coast is caught both by sea-lines and hand-lines, the hooks of which are baited with the usual marine sand-worm, or a portion of the body of some of the testaceous mollusca. The size of the Dab is commonly about eight or nine inches in length, and seldom exceeds twelve inches.

The form of the body is like that of the Flounder: the length of the head is to that of the body as one to five; the greatest breadth compared to the whole length is as two to five: the mouth and teeth small, the latter separated; the eyes rather large, the orbits divided, but the bony ridge is not very prominent; the length of the pectoral fin nearly two-thirds the length of the head; ventral fins small, in a line under the origin of the pectoral fin: the dorsal and anal fins extending along the body nearly to the tail, both ending on the same plane; the longest rays of both are placed behind the centre: tail slender, elongated, and slightly rounded. The fin-rays in number are—

D. 76 : P. 11 : V. 6 : A. 59 : C. 14.

The form of the body is subrhomboidal; the scales rough, their margins ciliated; the lateral line arched high over the pectoral fin, the remainder to the tail straight; the rays of the dorsal and anal fins scaled; the colour of the fish a uniform pale brown, with the under surface white.

SUBBRACHIAL
MALACOPTERYGII. *PLEURONECTIDÆ.*



LEMON DAB, SMOOTH DAB.

SMEAR DAB.—SANDFLEUK, *Edinburgh.*

TOWN-DAB, *Hastings.*—MARY-SOLE, *Devonshire.*

Rhombus lævis Cornubicus,	Jago, Ray, Syn. p. 162, f. 1.
La vraie Limandelle,	Duham. T. des Peches, t. iii. Sect. IX. p. 268, tab. VI. f. 3 and 4.
Platessa microcephalus,	*Smear Dab,* Flem. Brit. An. p. 198, sp. 106.
,, *microcephala,*	*Lemon Dab,* Jenyns, Man. Brit. Vert. p. 457, sp. 144.
Pleuronectes lævis,	*Smear Dab,* Penn. Brit. Zool. vol. iii. p. 309, pl. 47.
,, *microcephalus,*	*Small-headed Dab,* Don. Brit. Fish. pl. 42.
,, *microstomus,*	Nilsson, Prod. Ichth. Scand. p. 53.

The Lemon Dab, or Smooth Dab, is not of such frequent occurrence as the common Rough Dab; and is, on account of a mixture of various shades of reddish brown and yellow colours, a prettier fish to look at. It approaches to a rhomboid in form, even more so than any of the species of this genus as now restricted to a certain portion only of those Flatfishes that have the eyes on the right side.

In tracing the occurrence of the Smooth Dab round the coast, Dr. Neill of Edinburgh says it is taken off Seton Sands and Aberlady Bay. Dr. Richard Parnell, who has devoted great attention to the fishes of the Forth, and to whose kindness I am indebted for the largest example of this species I have yet seen, obtained it, and other specimens, on the Fifeshire coast during the months of February, March, and April. I have received specimens also from Dr. Johnston of Berwick. It is not uncommon in the London market; and is taken on the Sussex coast, where it is known by the name of Town-Dab. Colonel Montagu observed it frequently in Devonshire, where it is called Mary-Sole.

Mr. Couch says it is rather a rare fish in Cornwall, and does not readily take a bait; but he has known it to be caught in the trawl-nets. Mr. Couch adds, he has no doubt this fish is the Kitt of Jago, figured in Ray's Synopsis, No. 1; the fish being reversed on the paper, and appearing with its eyes and colour on the left side, as in the sinistral fishes.

Mr. Thompson says the Smooth Dab is widely distributed on the coasts of Ireland, but limited in numbers.

The flesh of the Smooth Dab is considered equal to that of the Common Dab, and the substance of the body is much thicker. This species spawns in May. It feeds on testaceous and crustaceous animals, and is said to feed also on chitons.

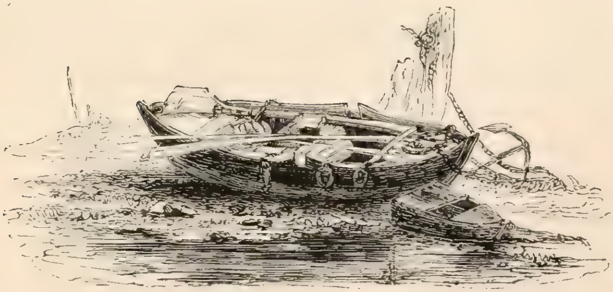
Duhamel was well acquainted with the Smooth Dab; but considered it a rare fish on the coast of France, and on some parts of it entirely unknown.

The form of the body rhomboidal; small-sized specimens are more elongated: the length of the head is to that of the head and body, without the caudal rays, as one to five and a half; the depth of the body, including the dorsal or anal fin, only just equal to half the whole length of the fish; the mouth small; lips tumid; the jaws equal in length; teeth in an even, close, regular row in each jaw, but extending further back on the white under side of the fish than on the upper or eye side; nostrils double: the eyes exactly over each other; the orbits separated by a strong, prominent, body ridge, but without tubercles: the head small; the pectoral fin but little more than half the length of the head; ventral fin small; the dorsal and anal fins reaching near to the tail, but distinct; the tail rounded. The fin-rays in number are—

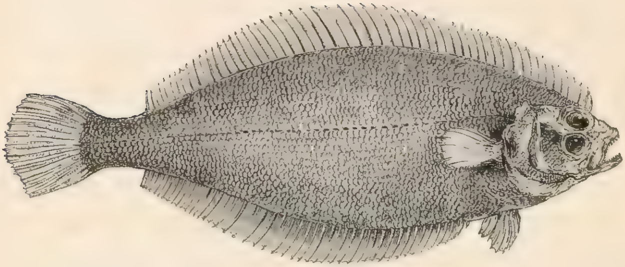
D. 86 : P. 10 : V. 5 : A. 70 : C. 16. Vertebræ 46.

The general colour of the upper surface of the body is a mixture of pale reddish brown and yellow, with small dark brown specks; the lips are orange, as is also the posterior edge of the operculum, and the anterior edge of the body immediately behind it: the body smooth, and covered with a mucous secretion; the lateral line but little arched over the pectoral fin; the under parts white.

The vignette below represents a Peter-boat as used by the Thames fishermen between and above the different bridges.



SUBBRACHIAL MALACOPTERYGII. *PLEURONECTIDÆ.*



LONG ROUGH DAB.

SANDNECKER. — SAND FLEUK, AND LONG FLEUK, *Edinb.*

Platessa limandoïdes, *Sandnecker*, JENYNS, Man. Brit. Vert. p. 459, sp. 146.
Pleuronectes ,, ,, PARNELL, Edinb. Phil. Journ. July 1835, p. 210.
,, ,, *Long Rough Dab*, BLOCH, pt. vi. pl. 186.

THE LONG ROUGH DAB is a very recent addition to the catalogue of British Fishes. The first notice I had of the occurrence of this species on our coast was in the autumn of 1833, from Dr. John Harwood, of St. Leonard's, near Hastings, who had seen a specimen that was taken on the Sussex coast. In the summer of 1834 I received two specimens from Dr. George Johnston of Berwick, which had been taken in that vicinity. In May 1835 I was favoured by Dr. Parnell with the largest specimen I have yet seen, measuring fifteen inches; who, at the same time, sent me word they were to be had frequently in the Frith of Forth in May, June, and July. Soon afterwards I learned by a letter from George T. Fox, Esq. of Durham, that a specimen of *Pl. limandoïdes* of Bloch had been taken some years before on the coast of Sunderland, and was still preserved in the possession of Thomas Wilkinson, Esq. of Bishop Wearmouth. The first recorded notice of this fish as British, that I am aware of, is that by Dr. Parnell, in the Edinburgh New Philosophical Journal, already quoted, where, by an error of the press, the fish is called *Pl. limandanus*, but this was corrected in the History of the Fishes of the Frith of Forth.

Bloch received his specimen from Hamburgh, and states that this fish is caught by the hook in the vicinity of Heligoland. He says it feeds on young crabs and young lobsters, and that its flesh is white and good.

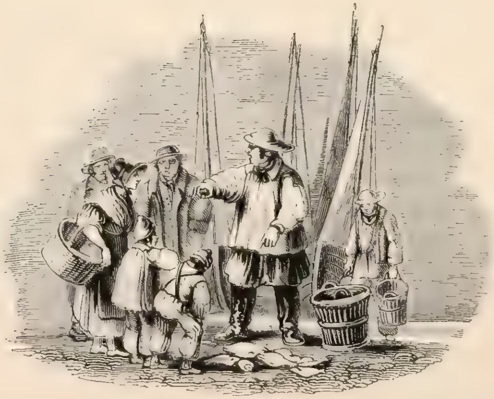
The length of the head compared to the whole length of the fish is as one to five; the breadth of the body, not including the dorsal or anal fins, is equal to one-third of the whole length; with the dorsal and anal fins it is equal to half the distance from the point of the nose to the end of the fleshy portion of the tail: the form of the body is an elongated oval, almost equally pointed at both ends; the parts of the mouth capable of some protrusion; teeth in a single row in each jaw, separate, conical, and curving slightly inwards: eyes rather large; the upper one a little before the line of the other; the orbits separated by a bony ridge: pectoral and ventral fins small; the former only half the length of the head: dorsal and anal fins extending nearly to the tail; both fins ending on the same plane: the tail slightly rounded.

The cheeks, operculum, and body, covered with harsh, ciliated scales, the surface exceedingly rough to the touch; a row of ciliated scales along each ray of the dorsal and anal fins; the lateral line straight, or very slightly inclining upwards as it approaches the operculum; the head and body one uniform pale brown; the fins lighter; the under surface of the body rough and white.

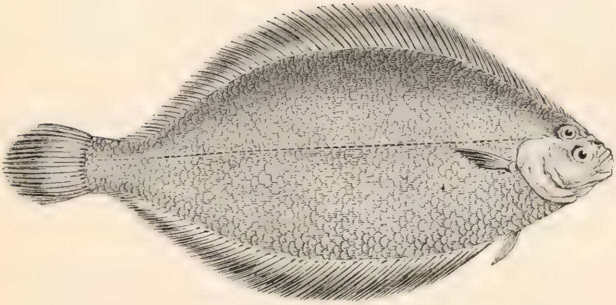
The fin-rays in number are—

D. 76 : P. 10 : V. 5 : A. 64 : C. 16.

The vignette represents a Folkstone fisherman selling his fish by auction on the beach after landing. This is done, according to the Dutch fashion, by lowering the price demanded for the lot till a bid is made, when the bargain is struck by dropping the shingle, which is held, as represented, between the fore-finger and thumb.



SUBBRACHIAL
MALACOPTERYGII. *PLEURONECTIDÆ.*



THE POLE, OR CRAIG FLUKE.

Platessa Pola,	*La Pole,*	CUVIER, Règne An. t. ii. p. 339.
,, ,,	*The Pole,*	JENYNS, Man. Brit. Vert. p. 458, sp. 145.
,, ,,	*Craig Fluke,*	PARNELL, Edinb. Phil. Journ. July 1835, p. 210.
Pleuronectes Pola,	*La Pole,*	LACEPEDE, vol. iv. p. 368. New 8vo. Edition, vol. x. p. 74.
,, *cynoglossus,*		LINN. Syst. Nat. i. p. 456.
,, ,,		GRONOV. Mus. Ichth. i. p. 14, sp. 39.
,, *nigromanus,*		NILSS. Prod. Ichth. Scand. p. 55.

THIS second addition to the British Fishes in the genus *Platessa* is still more rare on our coast than the *Pl. limandoïdes* last described. In the month of May 1833 I observed a specimen twelve inches long in the shop of Mr. Groves of Bond-street; and on pointing out the differences between this and other Flatfishes by comparison with several species among which it was placed for sale, and mentioning its rarity, Mr. Groves immediately sent it to the Zoological Society for preservation, observing that he had not noticed the difference, and did not recollect that he had ever seen that species before. From this specimen the woodcut was executed. In May 1835, Dr. Parnell very kindly sent to me from Edinburgh, for examination, a skin of this species nineteen inches in length, with several other preserved skins of fishes taken in the Frith of Forth, where the Craig Fluke, as this fish is there called by the fishermen, is occasionally taken in the months of April, May, and June.

These are the only examples of this fish taken in our seas that I am acquainted with. Of its habits but little, I believe, is known. Baron Cuvier states, in his *Règne Animal*, that in France the flesh of this species is in as great estimation as that of the Sole; and Lacépède states that it attains a length of twenty-four to thirty inches.

The head is small; its length compared to that of the whole fish is as one to six: the greatest breadth of body, dorsal and anal fins excluded, is to the whole length rather more than a third; including the dorsal and anal fins, rather less than a half: the form of the body an elongated oval, pointed at each end: the mouth small; the lips thin; a single row of teeth in each jaw, close set, smooth, incisor-like, with thin and even-cutting edges: the eyes rather large; the upper one ranging vertically behind the line of the lower, with the usual intervening bony ridge; irides orange: pectoral and ventral fins small: dorsal and anal fins extending very nearly the whole length of the body; both ending on the same plane; the rays about the middle of each the longest; those at the extreme ends, before and behind, very short: tail rather long and rounded.

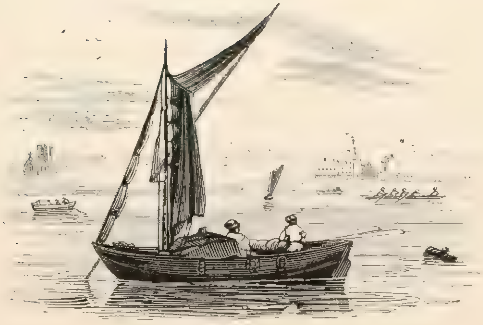
The fin-rays in number in one specimen were—

D. 109 : P. 11 : V. 7 : A. 93 : C. 19.

The body is quite smooth; the scales rather large, deciduous, but neither ciliated nor roughened in any way beyond a few radiating striæ; the head smooth, without tubercles;

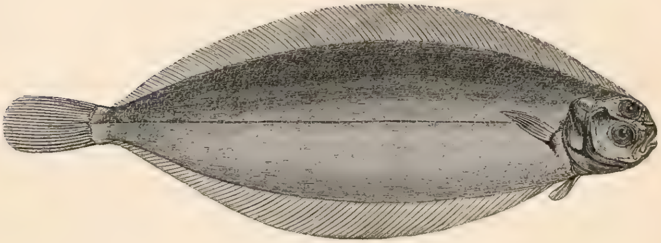
lateral line straight, and extending, as in all the other species of *Platessa*, to the end of the membrane connecting the caudal rays. The colour of the body uniform yellowish brown; the edges of all the fins darker: when dried for preservation, the colour of the skin of the body becomes clove brown; that of the fins brocoli brown.

The vignette below represents the Thames Peter-boat rigged with a fore-sail and main-sail, as used by the fishermen about Greenwich, and from thence along the course of the river downwards.



SUBBRACHIAL MALACOPTERYGII.

PLEURONECTIDÆ.



THE LONG FLOUNDER.

Platessa elongata, The Long Flounder, Yarrell, Suppl. to Brit. Fishes.

I am indebted to Mr. Baker, of Bridgewater, for several interesting communications on Birds and Fishes, one of the most valuable of which is the opportunity afforded me of making known what appeared to that gentleman to be a species of Flounder undescribed as a British Fish, and which, after having made the usual search, I have reason to believe is not only undescribed as a British Fish, but is altogether new to Ichthyology. I have only as yet seen the single specimen sent me for my use on this occasion by Mr. Baker, from which a drawing has been made of the natural size, and the reduced representation here given engraved on wood; but I understand from Mr. Baker's son that his father had obtained a second example of the same fish. The specimen now before me was obtained at Stoford, in Bridgewater Bay, in the month of December. Little is of course known of the habits of so recent and so rare an acquisition.

The whole length of this specimen is seven inches and three-quarters; the length of the head one inch and one quarter, and compared to the whole length of the fish, as one to six; the greatest breadth of the body, dorsal and anal fins included, is one inch and three-quarters, and compared to the whole length of the fish, as one to four and a half; the breadth, including the dorsal and anal fin, is to the whole length as three to eight. The body very thin, and very much elongated in form; the lateral line passing straight from the tail along the middle of the fish till it approaches the operculum, then rises in a slight curve over the base of the pectoral fin. The scales on the body are of medium size, oval, with numerous radiating striæ on the free portion. The fins deep, and the tail long.

The outline of the whole head is rather circular, the mouth oblique from below upwards, and below the line of the longitudinal axis of the body; the jaws nearly equal in length, each furnished with a single row of small and regular teeth; the eyes rather large, the upper eye, or that on the left side, being a little in advance of the lower, or that on the right side; the inter-orbital bony ridge prominent; the boundary lines of the preoperculum and operculum forming two concentric portions of circles. The pectoral fin, arising immediately behind the edge of the operculum, is about half as long as the head; the ventral fin, in a line under the edge of the operculum, is about half as long as the pectoral fin. The dorsal fin, commencing with short rays in a line over the eye, is at its greatest elevation about the middle of the fish, and from thence diminishes gradually to the end, which is on the fleshy portion of the tail, and short of the origin of the caudal rays; the anal fin begins close to the ventral fin, immediately behind the post anal spine; the first and last rays short, those in the middle of the fin the longest, and the fin ends on the same plane as the dorsal. The tail is elongated; its length equal to that of the head, and in form but slightly rounded at the end; the sides parallel.

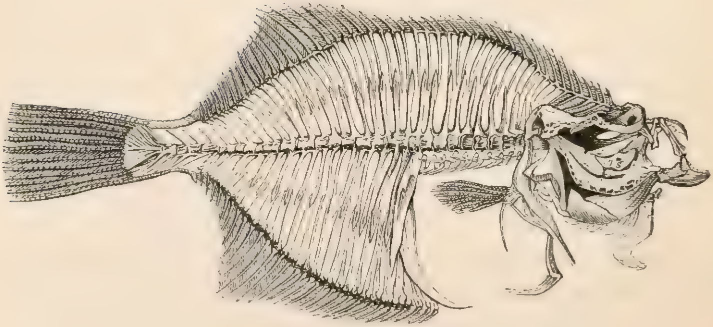
The fin-rays in number are—

D. 110 : P. 11 : V. 6 : A. 96 : C. 24.

The colour of this specimen on the upper surface is a uniform pale brown, the membranes of the different fins being rather lighter in colour than the body of the fish; the under surface of the body very pale wood-brown; the irides yellow.

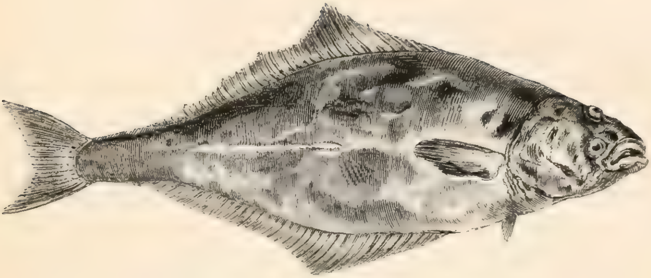
This specimen has been preserved dry.

The representation below is from the skeleton of the Common Flounder.



SUBBRACHIAL
MALACOPTERYGII.

PLEURONECTIDÆ.



THE HOLIBUT.

Hippoglossus vulgaris,	*Holibut,*	Flem. Brit. An. p. 199, sp. 108.
,, ,,	,,	Jenyns, Brit. Vert. p. 460.
,, ,,	*Fletan,*	Cuvier, Règne An. t. ii. p. 340.
,, ,,	,,	Willughby, p. 99, F. 6.
Pleuronectes hippoglossus,	,,	Linnæus. Bloch, pt. ii. pl. 47.
,, ,,	*Holibut,*	Penn. Brit. Zool. vol. iii. p. 302.
,, ,,	,,	Don. Brit. Fish. pl. 75.

Hippoglossus. *Generic Characters.*—With both eyes and the colour on the right side in the British specimen of this genus, and with fins similar to those of the species of the genus *Platessa* — the jaws and the pharynx are armed with teeth that are sharper and stronger, and the form of the body is more elongated.

The Holibut is one of the largest species of the *Pleuronectidæ*, but its capture is principally confined to the Northern fisheries: it is noticed by Pennant in his Arctic Zoology, and is well known on the coasts of Norway, Iceland, and Greenland. It is usually caught with lines and hooks. The Greenlanders eat the flesh of this fish both fresh and dried, for which latter purpose it is cut into long slips and exposed to the air. They are fished for successfully by the natives of the Orkneys, who ply their lines in the slack water and various eddies produced by the different islands, out of the race of the tides ; these quiet places being more particularly the haunts of the Holibut and Flatfish generally. A large quantity of oil is obtained from them.

The Holibut is not found in the Baltic, but it is taken on the west coast of Norway, and, according to Lacépède, at Iceland. It appears by the Appendix of Captain James C. Ross, that several were taken off the west coast of Greenland in July 1829, and Dr. Storer mentions that large quantities are brought to Boston market.

In our Northern seas, Holibuts weighing near five hundred pounds are said to have been obtained ; and examples of large size have occasionally occurred nearer home. In April 1828, a Holibut seven feet six inches in length, three feet six inches in breadth, and weighing three hundred and twenty pounds, was taken off the Isle of Man, and sent to Edinburgh market. It was said to have been the largest specimen ever exhibited there.

Mr. William Thompson mentions that the Holibut is common around the coast of Ireland ; and Mr. Couch says it is not uncommon in Cornwall. In London this fish is occasionally seen in the months of March and April : here, from its large size, it is sold in slices at a low price by the pound weight. The flesh, though white and firm, is dry, the muscular fibre coarse, with but little flavour : the head and fins are said to be the best parts. Specimens only two feet long are occasionally seen in summer, but in general the examples are much larger.

The Holibut feeds close to the ground, on the smaller species of Flatfish and various crustacea. It spawns in spring ; the roe is of a pale red colour, and the ova in the female very numerous. A specimen five feet two inches long, in the shop of a London fishmonger, supplied the means of obtaining the following description :—

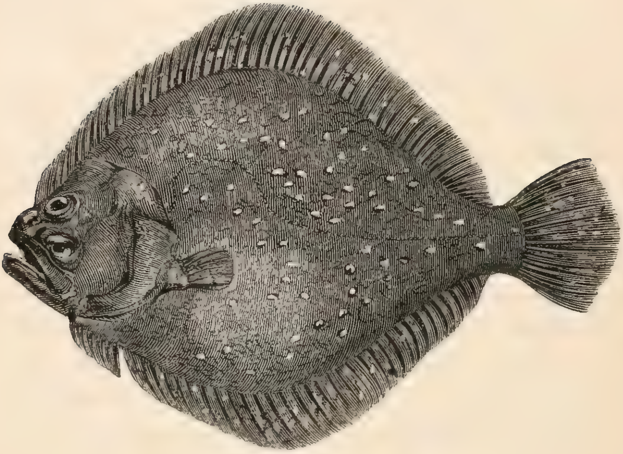
The length of the head compared to the whole length of the fish without the caudal rays, is as one to four; the greatest breadth one third of the whole length, dorsal, anal, and caudal fin-rays all excluded: the head small, but the mouth large; teeth in two rows in each jaw, small for the size of the fish, conical, pointed, and separated; the irides yellow, the pupils black; the pectoral fin on the coloured or dextral side one-fourth larger than that on the white or under side; the dorsal fin commences in a line over the eye, the rays longest over the widest part of the body; the anal fin of similar character: both dorsal and anal fins terminate on the same plane, and distinct from the caudal fin, the posterior margin of which is concave; the ventral fins are small, the white ventral fin of the under side the smaller of the two: immediately in advance of the commencement of the anal fin are two apertures; the anterior opening large, and evidently connected with the intestines; the posterior opening smaller, and apparently the outlet from the urinary bladder and sexual organs. The fin-rays in number were—

D. 104 : P. 16 : V. 6 : A. 81 : C. 16.

The form of the body elongated; the surface smooth, covered with small oval-shaped soft scales; the lateral line arched over the pectoral fin; the colour composed of different shades varying from light brown to dusky brown; the surface of the under side perfectly smooth and white.

SUBBRACHIAL
MALACOPTERYGII.

PLEURONECTIDÆ.



THE TURBOT.

RAWN FLEUK, AND BANNOCK FLEUK, *Scotland.*

Rhombus	*maximus,*	*Le Turbot,*	Cuvier, Règne An. t. ii. p. 340.
,,	,,	*Turbot,*	Willughby, p. 94, F. 2.
Pleuronectes	,,	Linnæus.	Bloch, pt. ii. pl. 49.
,,	,,	*Turbot,*	Penn. Brit. Zool. vol. iii. p. 315, pl. 49.
,,	,,	,,	Don. Brit. Fish. pl. 46.
,,	,,	,,	Flem. Brit. An. p. 196, sp. 96.
,,	,,	,,	Jenyns, Brit. Vert. p. 461.

Rhombus. *Generic Characters.*—Colour and eyes on the left side; teeth in the jaws and pharynx; dorsal fin commencing anterior to the upper eye; dorsal and anal fins extending very nearly to the tail.

The Turbot, so well known, so highly and so justly esteemed, is considered the best, as it is also one of the largest, of our Flatfishes; and, like the Salmon, notwithstanding its great excellence, and the immense numbers that are caught in various ways, it is still in great abundance, but not equally so on all parts of the coast.

According to Mr. Low, it is rare in Orkney; but the numbers taken increase on coming southward; and in the market of Edinburgh, according to Dr. Neill, it is commonly denominated Rawn Fleuk, from its being thought best for the table when in rawn,* or roe; it is sometimes also called Bannock† Fleuk, on account of its circular shape.

On the coasts of Berwick, Northumberland, Durham, and Yorkshire, a considerable fishery for Turbot is carried on by the fishermen with long lines, the mode of using which was described when speaking of the common Codfish. A large proportion of the Turbot produced in the English market is taken on or near the various sandbanks between the long line of our eastern shore and the coast of Holland. The writer of the article "Fisheries," in the edition of the Encyclopædia Britannica, now in course of publication, says, "The only fishery, perhaps, which neither the Scotch nor the English follow up with the same success as the Dutch, is that of the Turbot; the finest of which are supposed to be taken upon the Flemish banks. The Turbot fishery begins about the end of March, when the Dutch fishermen assemble a few leagues to the south of Scheveling. As the warm weather approaches, the fish gradually advance to the northward, and during the months of April and May they are found in great shoals on the banks called the Broad Forties. Early in June they have proceeded to the banks which surround the small island of Heligoland, off the mouth of the Elbe, where the fishery continues to the middle of August, when it terminates for the year. The mode of taking Turbot is as follows:—At the beginning of the season the trawl-net is used; which being drawn along the banks, brings up various kinds of Flatfish, as Soles, Plaice, Thornbacks, and Turbots; but when the warm weather has driven the fish into deeper water, and upon banks of a rougher surface, where trawling is no longer practicable, the fishermen have then recourse to their many-hooked lines. The hooks are baited with the common Smelt, and a small fish resembling an Eel, called the Gorebill.* Though very considerable quantities of this fish are now taken on various parts of our own coasts, from the Orkneys to the Land's End, yet a preference is given in the London market to those caught by the Dutch, who are supposed to have drawn not less than 80,000*l.* a year for the supply of this market alone; and the Danes from 12,000*l.* to 15,000*l.* a year for sauce to this luxury of the table, extracted from one million of lobsters, taken on the rocky shores of Norway,—though our own shores are in many parts plentifully supplied with this marine insect, equal in goodness to those of Norway."

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* In the West of England a different meaning is attached to this word: see the bottom of page 251.

† *Bannock*, a round flat cake.

About one-fourth of the whole supply of Turbot to the London market is furnished by Dutch fishermen, who pay a duty of 6*l.* per boat, each boat bringing from one hundred to one hundred and fifty Turbot. A very considerable quantity is also purchased of the Dutch fishermen at sea on the fishing stations near their own shore by English fishermen, and is brought by them to our market in their own boats, paying no duty.

Along our southern coast many Turbot are caught by the trawling vessels, and long-line fishing at particular seasons on the Varne and on the Ridge,—two extensive banks of sand, the first about seven miles, and the second about twelve miles, from Dover, towards the French coast. On these banks French fishermen also lay their long-lines; and when they do not succeed in selling their Turbot at sea, which suits them best, they freight one or more of their own boats with them, and send them into Dover harbour for sale, paying the usual duty. They are not, however, allowed to sell any fish but Turbot, except under particular circumstances. If in want of provision, or their boat has suffered damage from bad weather, they are then permitted, by certificate from a magistrate, to sell as much fish as will procure them food, or pay the cost of repairs.

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* Vol. i. page 442.

Along the Devonshire coast, where trawling on an extensive scale is practised, a portion of the Turbot and Dory is forwarded during the season to Bath and Exeter; the remainder is sent to the London market by land-carriage. It is observed that the Turbot of the northern part of our own coast, and those bought of or brought by the Dutch fishermen, are darker in colour than those from the south-western shores of England.

Mr. Couch says, "The Turbot keeps in sandy ground, and is a great wanderer, usually in companies; and though its proper habitation is close to the bottom, it sometimes mounts aloft, and I have known it upon the surface over a depth of thirty fathoms: I have been informed also of its pursuing to the surface a companion that was drawn up by the line, when both were taken together."

The Turbot, though a voracious fish, is particular as to the quality of its food: the bait used for him should be very fresh; if it happens to be in the least degree tainted, the Turbot will not touch it. The most enticing baits to use are those small fishes which are either very bright in colour or very tenacious of life; the Atherine, and the two common species of the genus *Cottus*, the Sea-Scorpion and Father-Lasher, are most frequently used: the first attracts by its shining silvery appearance, and the others by living a long time on the hook, and showing themselves in their struggles to get free. The River Lampern was formerly used in large quantities by the Dutch, and was a great favourite with them as baits for Turbot, on account of the facility with which they could be kept alive while the boats were at sea, and combining bright silvery colour with great power of resisting the usual effect of mutilation. The principal food of the Turbot is small fish, crustacea, and mollusca. It spawns about August, but rapidly recovers its condition and firmness.

Turbot are recorded as having been taken on the south coast of Ireland; I have seen one that was caught on the coast of Londonderry in the north: and this valuable species occurs also at many intermediate localities.

" The Turbot was known to the Athenians, and has been ever since a worthy object of gastronomical worship." The most common size varies from five to ten pounds' weight; occasionally this fish attains to twenty pounds, and sometimes thirty pounds. Mr. Couch notices, in his MS. a record of one taken in the year 1730, at Cawsand, near Plymouth, which weighed seventy pounds. Rondeletius states that he had seen a Turbot five cubits in length, four in breadth, and a foot in thickness. The Turbot is considered to have been the *Rhombus* of the ancient Romans, of which a specimen of enormous size is said to have been taken in the reign of Domitian, who ordained a *Senatus Consultum* to devise the best mode of bringing it to table.—*Juven. Sat. IV.*

" No vessel they find fit to hold such a fish,
And the senate 's convoked to decree a new dish."

Sir Thomas Browne seems to have been quite aware of the good qualities of Turbot and Brill as compared to Plaice, Flounders, and Dabs; he says—

" Of wry-mouthed fish, give me the left side black;
Except the Sole, which hath the daintiest smack."

Yet a Plaice, scored and fried, is a good fish, and much better than when boiled.

Quin, of epicurean notoriety, is said to have given it as his opinion that the flesh on the dark-coloured side of the Turbot was the best meat; and as examples occasionally occur that are dark-coloured on both sides, some London fishmongers, from experience in their good qualities, recommend such fish as deserving particular attention. Reversed Turbots, as they are called,—that is, Turbots having the eyes and dark colour on the right side instead of the left,—are also occasionally brought to market: I have seen two or three such; but they have exhibited a slight degree of malformation in the form of a notch or depression on the top of the head. The *Pleuronectes cyclops* of Mr. Donovan, plate 90, I believe to be an example of the young fry of the Turbot, the head of which is not perfectly formed.

The number of Turbot brought to Billingsgate market within twelve months, up to a recent period, was 87,958; and the number of lobsters within the same period 1,904,000.

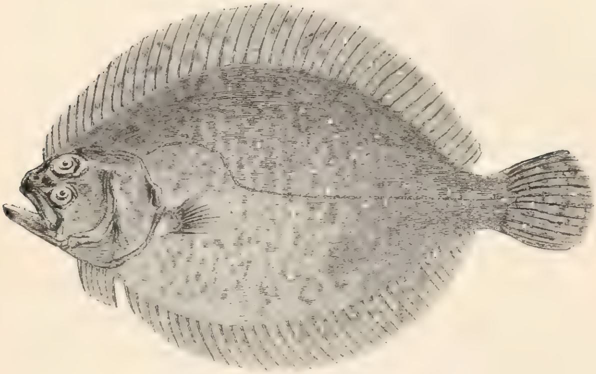
The form of the Turbot, exclusive of the caudal rays, is nearly round: the length of the head compared to the length of the head and body alone is as one to three; the depth of the body, including both dorsal and anal fins, is equal to the length from the nose to the end of the fleshy portion of the tail: the mouth is large, the direction of the opening obliquely upwards: the teeth small and numerous in both jaws; the eyes in a vertical line one directly over the other; the whole surface of the cheeks, and all the parts of the gill-cover on the upper or coloured side, studded with numerous tubercles; the operculum ending in an angle directed backwards and over the base of the pectoral fin; the gill-openings large; the pectoral fin small; the dorsal fin, commencing by short rays immediately over the nostril and anterior to the upper eye, extends very nearly to the end of the fleshy portion of the tail, where the rays are again short, the longest rays being over the middle of the body; the ventral fins broad, placed very far forward, appearing like the commencement of the anal fin, and only separated from it by a narrow space; the anal fin ending by short rays near the tail, and on the same vertical plane as the dorsal; the caudal rays moderately long, and slightly rounded. The fin-rays in number are—

D. 64 : P. 12 : V. 6 : A. 48 : C. 15. Vertebræ 30.

The whole of the upper or coloured side of the body studded with hard roundish tubercles, the surface otherwise smooth; the scales small, the prevailing colour varying shades of brown, the fins a little lighter; the lateral line arched high over the pectoral fin, then straight to the tail; the under surface of the body is smooth, and generally perfectly white.

The vignette represents a Dutch boat.

SUBBRACHIAL
MALACOPTERYGII. *PLEURONECTIDÆ.*



THE BRILL.

PEARL, KITE, BRETT, BONNET-FLEUK.

Rhombus vulgaris,	*La Barbue,* Cuvier, Règne An. t. ii. p. 341.
,, *non aculeatus,*	Willughby, p. 95, tab. F. 1.
Pleuronectes rhombus,	Linnæus. Bloch, pt. ii. pl. 43.
,, ,,	*Pearl,* Penn. Brit. Zool. p. 321, pl. 50.
,, ,,	*Brill,* Don. Brit. Fish. pl. 97.
,, ,,	,, Flem. Brit. An. p. 196, sp. 97.
,, ,,	,, Jenyns, Brit. Vert. p. 462.

The Brill is a well-known fish, brought in abundance to the London market, and procured from the same localities and by the same modes as the Turbot; but is not held in equal estimation, being considered by some as inferior to the Sole, but very superior to the Plaice.

Dr. Neill says it is found in Aberlady Bay, where it is called Bonnet-Fleuk; it is taken also at Yarmouth, and other places along our eastern coast. It is abundant on our southern coast, inhabiting sandy bays as well as deep water, from whence the principal part of the supply for the London market is derived. It is taken also in Ireland. Its food, as well as its season of spawning, are similar to the Turbot, but it does not usually appear so large, seldom exceeding eight pounds in weight. It should be borne in mind, that the Kite of the Devonshire and Cornish coasts is the same as the Brill; but that the Kit of Jago is the Smooth or Small-headed Dab, figured and described in this volume at page 309. Another name quoted among those in use for the Brill, namely, the Brett, is said to be derived from the Cornish word "brit;" that is, speckled or spotted.

The writer of the supplementary part to the Class Fishes, in Mr. Griffith's edition of Cuvier's Animal Kingdom, says that the enormous fish presented to the Roman Emperor Domitian was a Brill, *Rhombus vulgaris* of Cuvier, and not the Turbot; but the authority or the reasons for this opinion are not given. Bloch, in his account of the Brill, makes a similar statement.

The length of the head from the point of the lower jaw to the edge of the operculum is, when compared to the length of the body alone without the head or caudal rays, as one to two; the breadth of the body, dorsal and anal fins excluded, equal to half the whole length of the entire fish; the whole breadth, dorsal and anal fins included, is to the whole length as two to three: the form of the body rhomboidal; the surface perfectly smooth; the position and extent of the fins very similar to those of the Turbot last described; a few of the most anterior rays of the dorsal fin extend beyond the connecting membrane; the tail rounded.

The fin-rays in number are—

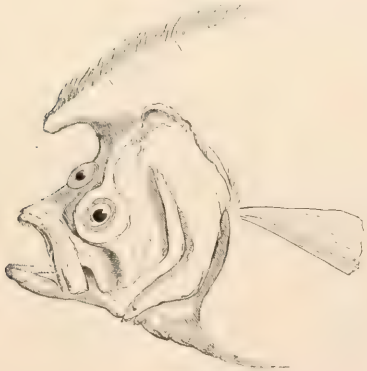
D. 76 : P. 10 : V. 6 : A. 59 : C. 16. Vertebræ 35.

The mouth is large, deeply cleft; under jaw the longest;

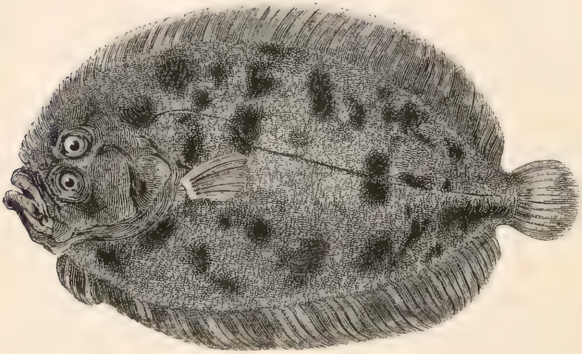
teeth numerous, small, pointed, and sharp: the upper eye behind the lower one in a vertical line: irides yellow: cheek and operculum smooth, without tubercles; basal and ascending marginal lines of the preoperculum forming nearly a right angle; lateral line arched over the pectoral fin, then straight to the end of the tail: the scales are nearly round, small, and smooth; the colours of the body a reddish sandy brown, varied with darker brown, and sprinkled over with white pearl-like specks, whence, probably, another of the names bestowed on this fish has originated: the under surface is smooth and white.

The young are of a pale reddish brown, marked with very dark brown or black spots.

The vignette represents the outline of the anterior part of a Brill with a malformed head. For the fish from which this sketch was taken, I am indebted to the kindness of Mrs. Nelson of Devonport. It was taken in that vicinity in June 1835, and was brought on shore alive.



SUBBRACHIAL
MALACOPTERYGII. *PLEURONECTIDÆ.*



MULLER'S TOPKNOT.

Rhombus hirtus,	*Muller's Topknot,* YARRELL.
Pleuronectes hirtus,	MULLER, Zool. Dan. vol. iii. p. 36, pl. 103.
,, *punctatus,*	*Topknot,* PENN. Brit. Zool. vol. iii. p. 322, pl. 51, and edit. 1776, pl. 41, but named by mistake Smear Dab.
Le Gros Plie ou Targeur,	DUHAMEL, sect. ix. pl. 5, fig. 4.
Pleuronectes hirtus,	*Muller's Topknot,* JENYNS, Man. Brit. Vert. p. 463, sp. 151.

SEVERAL modern authors have confounded the present fish with the species next to be described; and Cuvier,* as well as Professor Nilsson,† have brought together the *Pleuronectes hirtus* of Muller, and the *Pl. punctatus* of Bloch, apparently considering them as the same fish. Muller doubted whether the *punctatus* of Bloch was the same as his fish, and notices the points in which they differ. The opportunity of examining some specimens very recently, confirms the existence of two distinct species on our shores. Though somewhat similar in the form of the body, the colouring, and the spots, there are still the following well-marked distinguishing specific characters.

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* Règne An. t. ii. p. 341.

† Prod. Ichth. Scand. p. 59, sp. 11.

The *hirtus* of Muller, and those included in the synonymes here given, have the eye or coloured side only of the body rough; the under side smooth; the eyes and mouth small: the first ray of the dorsal fin not longer than the succeeding rays; the ventral and anal fins united; the dorsal and anal fins also connected to the tail by a membrane; the tail short and rounded; the scales of the body when detached higher than wide.

The *punctatus* of Bloch, and the fishes included under the synonymes given with the next species, have both sides of the body rough; the eyes large and prominent; the mouth larger than in *hirtus*, and not placed so obliquely; the first ray of the dorsal fin elongated; the ventral and anal fins separated; the tail rather long; the scales of the body when detached wider than high.

The *hirtus* of Muller appears to be the most common species of the two; but neither occur very frequently. Dr. Parnell has obtained it in the Forth, where it is occasionally caught in the crab-cages. I have received a specimen from Dr. George Johnston, which was taken near Berwick Bay; and I am indebted to Professor Henslow of Cambridge for a drawing of one taken in the Medway. Dr. John Harwood, of St. Leonard's, possesses a specimen taken on the Sussex coast; and both Colonel Montagu and Mr. Hanmer obtained specimens in Devonshire.

Mr. Couch considers it not an uncommon fish in the West of England, and has furnished me with two examples, from one of which the figure was taken. It appears to keep among rocks, where it is not readily distinguished, on account of the similarity in its colour to the sea-weed; and it is chiefly taken in the nets which are set for Red Mullet. In winter the boys find small ones, not larger than a half-crown piece, in the pools left by the tide. This species of Flatfish does not probably attain any great size; the largest examples I have seen not exceeding seven or eight inches in length. It is said to feed on mollusca and small star-fishes.

Mr. Baker, of Bridgewater, sent me a specimen, beautifully preserved, that had been taken in the Bristol Channel: and I have a record of one that was caught on the coast of the county of Down in Ireland.

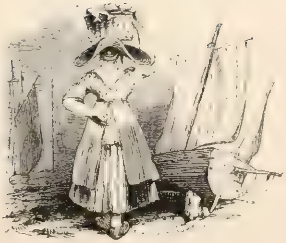
The whole length of the specimen described is five inches and one quarter; the length of the head compared to that of the body, without the caudal rays, is as one to two and a half; the breadth of the body, not including the dorsal and anal fins, half of the whole length: the form of the body, including both these fins, is rhomboid: the dorsal fin commences immediately over the upper lip, the rays lengthening by degrees, and being longest over the posterior third part of the body; the pectoral fin small: the ventral fins placed in a vertical line under the middle of the head, and attached to the commencement of the anal fin by a membrane: this latter-named fin commences under the line of the ascending posterior margin of the preoperculum; both dorsal and anal fin end on the same plane, and are connected to the fleshy portion of the tail by a membrane; the tail small and rounded. The fin-rays in number are—

D. 90 : P. 11 : V. 6 : A. 70 : C. 14. Vertebræ 33.

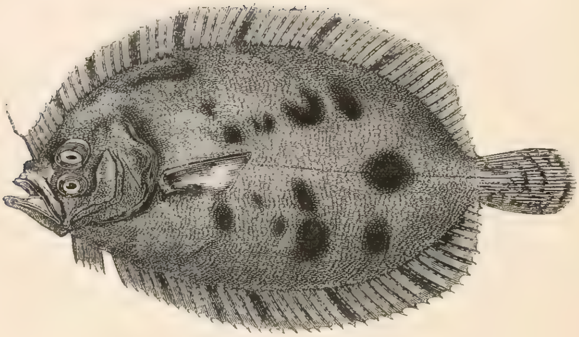
The mouth is small, the position almost vertical; the teeth distinct, small, conical, and sharp: the diameter of the eye equal to one-fourth of the length of the head; the upper eye placed behind the line of the lower to the distance of nearly one-half its width: the basal and ascending marginal lines of the preoperculum form an obtuse angle; the cheeks, operculum and body, covered with denticulated scales, which in shape, when detached, are longest in their vertical diameter.

The colour of the body is a reddish brown, mottled and spotted with very dark brown or black; a large, conspicuous dark spot behind, but above the ends of the pectoral fin-rays; the lateral line curved over the pectoral fin, then descending and intersecting the lower portion of the large dark spot, afterwards passing straight to the tail; the fins paler brown than the body; all the rays of the dorsal and anal fins with a line or row of denticulated scales along their upper surface; the under side of the body smooth and white.

The vignette represents a fishwoman at Scheveling.



SUBBRACHIAL MALACOPTERYGII. *PLEURONECTIDÆ.*



BLOCH'S TOPKNOT.

Rhombus punctatus,	*Bloch's Topknot,* YARRELL.
Pleuronectes ,,	BLOCH, pt. vi. pl. 189.
La petite Limande,	DUHAMEL, sect. ix. pl. 6, fig. 5.
Pleuronectes punctatus,	FLEM. Wern. Mem. vol. ii. p. 241.
,, ,,	,, Phil. Zool. pl. 3, fig. 2.
,, ,,	,, Brit. An. p. 196, sp. 99.
Rhombus unimaculatus,	RISSO, Hist. tom. iii. p. 252, fig. 35.
Pleuronectes punctatus,	*Bloch's Topknot,* JENYNS, Man. Brit. Vert. p. 462, sp. 150.

THE *Pleuronectes punctatus* of Bloch, or, as it is here called to preserve the appropriation, Bloch's Topknot, is much more rare than the Topknot of Muller; but appears, like it, to have an extended range. Professor Nilsson includes but one species in his Fishes of Scandinavia, and brings together the trivial names of the *hirtus* of Muller and the *punctatus* of Bloch.

By a paper published in the Swedish language by M. B. F. Fries of Stockholm in 1839, and of which a translation in

German is given in M. Wiegmann's Archives for 1840, it appears that the Swedish Ichthyologist had obtained an example of the *P. punctatus* of Bloch, which fish had not been recognised as a distinct Scandinavian species. The examination of this specimen had satisfied M. Fries that the views of Mr. Jenyns and myself were correct as to the distinctions between the *P. hirtus* of Muller and the *P. punctatus* of Bloch.

Dr. Fleming procured the true *punctatus* in Zetland, where, according to the testimony of the fishermen, it is not uncommon. Professor Henslow obtained at Weymouth the specimen from which Mr. Jenyns' description and the figure here inserted were taken. A third example has been caught on the coast of the North of Ireland, as recorded by Mr. William Thompson of Belfast. A comparison of the figures and descriptions referred to under the present fish with those of the *Rhombus unimaculatus* of M. Risso, in his *Histoire Naturelle*, will convince the observer that they are intended for the same fish.

Bloch, if he has correctly figured his species, was, I think, mistaken in supposing his fish to be the same as *Le Gros Plie ou Targeur* of Duhamel; as the separation between the ventral and the anal fins, and the want of connexion between the ends of both dorsal and anal fins with the tail, will demonstrate on comparing the two figures; but the character and disposition of the spots are something like those of Muller's fish. The figure by Dr. Fleming, in his Philosophy of Zoology, wants only the greater elongation of the first ray of the dorsal fin, perhaps a sexual distinction, to render it identical with the figure here given, and that by M. Risso.

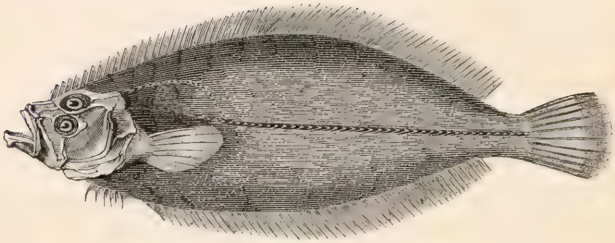
I avail myself, by permission, of the very full description of this fish given by Mr. Jenyns in his Manual, taken from the specimen in the collection of the Philosophical Society of Cambridge.

"Length five inches and a half. Form roundish oval; the dorsal and ventral lines equally convex: greatest breadth, fins excluded, just half the length: head a little less than one-third of the same: profile notched immediately before the eyes: mouth of moderate size, very protractile; jaws nearly equal; the lower one a very little the longest, and ascending obliquely at an angle of rather more than forty-five degrees: teeth so fine as to be scarcely visible: eyes large, remarkably full and prominent; their diameter about one-fourth the length of the head; placed on the left side; approximating; the lower one rather more advanced than the upper; between them a projecting ridge; basal and posterior margins of the preopercle meeting at a very obtuse angle, the former rising obliquely to meet the latter; lateral line commencing at the upper part of the opercle, at first very much arched, but afterwards straight: both sides of the body, but more especially the upper, extremely rough: scales minute; those on the upper side having their free margins set with from four to six denticles; those beneath having the denticles finer and more numerous: dorsal fin commencing immediately in advance of the upper eye, and extending very nearly to the caudal, at the same time passing underneath the tail, where the rays become very delicate; greatest elevation of the fin near its retral extremity; first ray very much produced, nearly three times the length of those which follow; most of the rays divided at their tips; some of the last in the fin branched from the bottom: anal fin commencing in a line with the posterior angle of the preopercle, answering to the dorsal, and terminating in the same manner beneath the tail; greatest elevation corresponding: caudal oblong, the extremity rounded: pectorals inserted behind the posterior lobe of the opercle, a little below the middle; the first ray very short, the next three or four longest, the succeeding ones nearly as long; pectoral on the eye side rather larger than that on the side opposite: ventral fins immediately before the anal, and appearing like a continuation of that fin, but not connected with it, as in the other species: vent situated between the two last pairs of rays: the rays of all the fins covered with rough scales nearly to their tips. The numbers of the fin-rays are—

D. 87 : P. left side 12 : right side 11 : V. 6 : A. 68 : C. 16.

"The colour above brown, or reddish brown, mottled and spotted with black; a large round spot, more conspicuous than the others, in the middle of the side towards the posterior part of the body; fins spotted: under side plain white."

SUBBRACHIAL
MALACOPTERYGII. *PLEURONECTIDÆ.*



THE WHIFF.

THE CARTER, *Cornwall.*

Rhombus megastoma,	*Whiff,*	Yarrell.
,, ,,	*La Cardine,*	Cuvier, Règne An. t. ii. p. 341.
Passer Cornubiensis,	*Whiff,*	Ray, Syn. p. 163, fig. 2.
Pleuronectes pseudopalus,	,,	Penn. Brit. Zool. vol. iii. p. 324, pl. 52.
,, *megastoma,*	,,	Don. Brit. Fish. pl. 51.
,, ,,	,,	Flem. Brit. An. p. 196, sp. 98.
,, ,,	,,	Jenyns, Brit. Vert. p. 464.

The Whiff appears to have been first described and figured by Ray from Mr. Jago's Catalogue of Cornish Fishes, which is introduced, with short notices and representations, in Ray's Synopsis. This fish seems to occur more frequently in Devonshire and Cornwall than on any other part of our coast. Mr. Couch says, "This species is well known to the Cornish fishermen, who apply the name of Carter to it. It keeps on sandy ground, at no great distance from land, and takes a bait, so that it is caught as often as any of the salt-water Flatfishes; but it is not highly esteemed for the table, chiefly from being so thin." From this cause it is sometimes called

Lantern-fish, in reference to its semi-transparency when held up between the eye and the light; but from experience I can say that the flesh is excellent when fried, almost as good as that of the Sole.

Mr. Donovan found it in Wales; it is not unfrequent in Ireland. Mr. Jenyns has described it in his valuable Manual of the British Vertebrate Animals, from a specimen obtained by Professor Henslow at Weymouth. Most of the specimens recorded measured from eighteen to twenty-one inches in length.

Dr. Johnston says it is rare at Berwick, and Dr. Parnell does not include it among his Fishes of the Forth.

But few particulars are known of this fish. It appears but seldom in the London market: I obtained one in June 1834 which measured seventeen inches in length, from which a representation and the following description are taken.

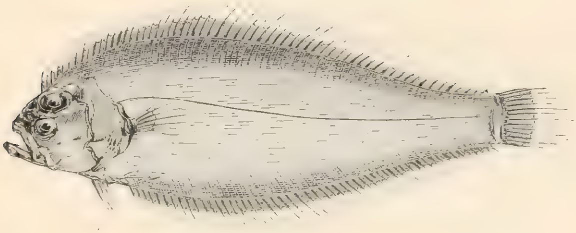
The length of the head from the point of the upper jaw to the posterior edge of the operculum, compared to the length of the body alone, without the head or caudal rays, is as one to three; the breadth of the body, dorsal and anal fins excluded, is to the whole length of the fish rather less than one third: the dorsal fin commences half-way between the point of the nose and the anterior edge of the upper orbit, and extends to within three-quarters of an inch of the end of the fleshy portion of the tail and the base of the caudal rays; the pectoral fin on the under or white side is considerably smaller in size, and contains two rays less, than that on the upper side; the ventral fins are of some extent at the base, as in the preceding species of the genus *Rhombus;* the anal fin commences in a line under the origin of the pectoral fin, extends along the whole length of the abdominal line, and ends near the tail on the same plane as the dorsal fin; the fleshy portion of the tail is narrow; the caudal rays three inches long, and slightly rounded.

The fin-rays in number are—

D. 89 : P. 11 : V. 6 : A. 71 : C. 13. Vertebræ 41.

The mouth is large; the lower jaw the longest, with a rounded projection under the symphysis; the teeth on both jaws numerous, pointed, and sharp: the eyes large; the upper one the most so, and placed farther back than the lower; the orbits separated by a prominent bony ridge: the lateral line conspicuous, elevated, and double over the pectoral fin, one portion being a continuation of the prominent straight line along the body, the other taking a high curve over the pectoral fin; both lines ultimately approaching each other again at the upper angle of the operculum, as shown in the woodcut: the form of the body is an elongated oval; the surface rough; the scales rather large; the colour a uniform yellow brown; the fins rather lighter; the under side smooth and white. A specimen in the British Museum exhibits faint indications of various spots, as shown in Mr. Donovan's coloured plate, and in the figure by Ray in his Synopsis, but this is not uniformly the case.

SUBBRACHIAL MALACOPTERYGII. *PLEURONECTIDÆ.*



THE SCALDFISH.

MEGRIM, *Cornwall.* SMOOTH SOLE.

Rhombus Arnoglossus,	*Scaldfish,*	Yarrell.
,, ,,	,,	Cuvier, Règne An. t. ii. p. 342.
Arnoglossus lævis,	,,	Willughby, p. 102, F. 8, fig. 7.
Pleuronectes casurus,	,,	Penn. Brit. Zool. vol. iii. p. 325, pl. 53.
,, *Arnoglossus,*	,,	Flem. Brit. An. p. 197, sp. 100.
,, ,,	,,	Jenyns, Brit. Vert. p. 465.
Rhombus nudus,	,,	Risso, Hist. t. iii. p. 251, sp. 141.

The Scaldfish, or Megrim, as it is called in Cornwall, appears, like the species last described, to be in this country, as far as we yet know, exclusively confined to the southern coast, and is only at present recorded as having been taken between Weymouth and the Land's End.

Mr. Couch says, " he has never known it take a bait, and its diminutive size prevents its being an object of attention to fishermen ; but they say it is much preyed upon by Congers and other large fishes, in the stomachs of which they often find it : it follows from this that it keeps in deep water." It seldom exceeds four or five inches in length ; but Mr. Couch has seen one that measured six inches and a half. M. Risso says the females are very prolific.

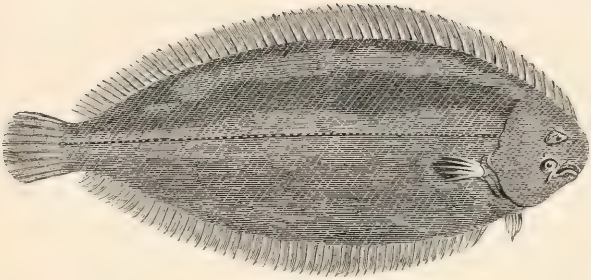
The length of the head is to that of the body as one to three, caudal rays excluded; the depth of the body, without the dorsal or anal fins, equal to one-third of the whole length; the dorsal fin commences over the upper eye, and reaches very nearly to the end of the fleshy portion of the tail; the pectoral fin long and narrow, but shorter and smaller on the under side; ventral fins under the gill-cover; the anal fin commencing in a line under the pectoral, and ending near the tail on the same plane as the dorsal fin; caudal rays of moderate length, and slightly rounded; but the rays of all the fins in both the specimens before me, from which the description is taken, extend considerably beyond the connecting membranes of each, as shown in the woodcut.

The fin-rays in number are—

D. 87 : P. 6 : V. 10 : A. 60 : C. 18.

The mouth is large, with small teeth in both jaws; lower jaw the longest when separated: eyes rather large; pupils blue; irides yellow; orbits separated by a bony ridge; upper eye larger than the lower, and placed more backward in a vertical line: body in shape an elongated oval, narrowed towards the tail; the scales large, round, thin, and transparent, almost all wanting, so easily are they removed on the slightest touch; the body of the fish appears naked. I am indebted to the kindness of Mr. Couch for a Cornish specimen: I also possess one from the Mediterranean, which enables me to say that our fish is the *Rhombus nudus* of M. Risso, as quoted. The lateral line after its commencement at the posterior edge of the operculum rises over the pectoral fin rather higher than the representation indicates; then descending gradually, deviates but little from a straight line throughout the remainder of its course to the tail. The colour of both specimens is alike, a uniform pale yellow brown.

SUBBRACHIAL MALACOPTERYGII. *PLEURONECTIDÆ.*



THE SOLE.

Solea vulgaris,	*La Sole,*	Cuvier, Règne An. t. ii. p. 342.
,, ,,	*A Sole,*	Merrett, Pinax, p. 187.
Buglossus seu Solea,	*Sole,*	Willughby, p. 100, F. 7.
Pleuronectes Solea,	,,	Linnæus. Bloch, pt. ii. pl. 45.
,, ,,	,,	Penn. Brit. Zool. vol. iii. p. 311.
,, ,,	*Common Sole,*	Don. Brit. Fish. pl. 62.
Solea vulgaris,	*Sole,*	Flem. Brit. An. p. 197, sp. 101.
,, ,,	,,	Jenyns, Brit. Vert. p. 466.

Solea. *Generic Characters.*—Both eyes and colour on the right side; the mouth distorted on the side opposite the eyes; small teeth in both jaws, but confined to the under side only, none on the same side as the eyes; form of the body oblong; dorsal and anal fins extend to the tail.

The common Sole is so universally known as to require only a particular notice of those points in its economy that are the least obvious. It inhabits the sandy shore all round our coast, where it keeps close to the bottom, feeding on the smaller testaceous animals, and the spawn and fry of other fishes. It is taken among the Orkneys, and along the north-east coast; but it is of small comparative size: the Soles of the south and west are much larger, and considered otherwise superior to those of the north and east.

The Sole is found northward as far as the Baltic and the seas of Scandinavia; and southward, along the shores of Spain, Portugal, and the Mediterranean. It was first described by Bellon.

Soles—and of these an enormous quantity—are caught almost entirely by trawling; they seldom take any bait. It is usual to send them to market in baskets, within which the Soles of small size, called Slips, are arranged nearest the wicker-work forming the outside of the basket: the larger Soles, being more valuable, are packed in the middle. Eighty-six thousand bushels of Soles have been received at Billingsgate market only within twelvemonths.

The Sole is found full of roe at the latter end of February. They are then for a few weeks soft and watery; but they soon recover, and throughout a great portion of the year are deservedly in high estimation: the flesh is white, firm, and of excellent flavour; those in deep water are the finest in quality.

The principal trawling-ground in England is along the south coast from Sussex to Devonshire: the Sole has also been taken on the shores of various counties in Ireland, viz. Cork, Waterford, Antrim, Londonderry, and Donegal. On the Devonshire coast the great fishing station is at Brixham in Torbay; the boats from which, using large trawling-nets from thirty to thirty-six feet in beam, produce a continual supply. Soles of very large size are occasionally taken. I have a record of one pair taken in Torbay which measured twenty-three inches in length each, and weighed together ten pounds; but for the particulars of the largest I have heard of, I am indebted to the kindness of the Rev. W. F. Cornish, of Totness. This specimen, a remarkably fine-grown fish, and very thick, was twenty-six inches long, eleven inches and a half wide, and weighed nine pounds.—Totness market, June 21st, 1826.

Soles appear to thrive well in fresh water. Dr. M'Culloch, in his papers on "Changing the Residence of certain Fishes from salt water to fresh,"[*] says, he was informed that a Sole had been kept in a fresh-water pond in a garden for many years; and adds, that in Mr. Arnold's pond at Guernsey, which has been before referred to, the Sole becomes twice as thick as a fish of the same length from the sea. A letter from a gentleman residing on the banks of the Arun contains the following statement:—"I succeeded yesterday in seeing the person who caught the Soles about which you inquire, and who has been in the constant habit of trawling for them with a ten-feet beam trawl in this river for the last forty years. The season for taking them is from May till November. They breed in the river (Arun), frequenting it from the mouth five miles upwards,[†] which is nearly to the town of Arundel, and remain in it the whole year, burying themselves in the sand during the cold months. The fisherman has occasionally taken them of large size, two pounds' weight each, but frequently of one pound; and they are thicker in proportion than the Soles usually caught at sea: in other respects, precisely the same; and it is evident they breed in great numbers in the river from the quantity of small ones about two inches long that are constantly brought on shore when drawing the net for Grey Mullet."

Reversed Soles—that is, having the eyes and the brown colour on the left side instead of the right—are not uncommon: and I possess a specimen that is of the usual dark colour, with rough ciliated scales on both sides.

The length of the head is to the whole length of the entire fish as one to six; the breadth of the body, dorsal and anal fins excluded, compared to the whole length, as one to three:

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[*] Royal Institution Quarterly Journal, No. xxxiv. July 1824, and No. xxxviii. July 1825.

[†] For a view of this part of the Arun, see vol. i. page 244.

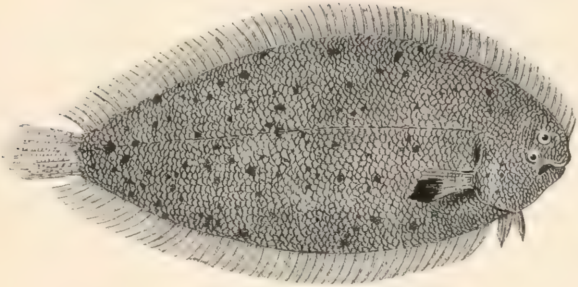
the nose is rounded and produced, projecting beyond the mouth: the upper jaw the longest; both jaws furnished with minute teeth on the under or white side of the fish only; the eyes small; the lower eye over the angle of the mouth; the upper eye placed more forward in a vertical line; the irides yellow; the pupils blue; the space between the eyes, the cheek, and operculum, flat, and covered with small rough ciliated scales: the pectoral and ventral fins small; the dorsal fin begins at the point of the nose, the anal fin under the line of the edge of the gill-cover; both extend the whole length of the body, ending on the same plane, near the base of the caudal rays; and both these fins have a series of small, rough, ciliated scales, extending along the line of each ray: the tail rather long, and slightly rounded.

The fin-rays in number are—

D. 84 : P. 7 : V. 5 : A. 67 : C. 17. Vertebræ 47.

The form of the body is a long oval, widest at a short distance behind the head, becoming narrower and rather pointed towards the tail; the colour on the upper side almost a uniform dark brown; the scales small, each ciliated at the edge, and rough to the touch; the lateral line running straight from the tail forward to the operculum, then rising and ending on a line with the superior edge of the upper orbit; the pectoral fin tipped with black. On the under side the colour is white: about the nostril and mouth are numerous soft papillæ.

SUBBRACHIAL MALACOPTERYGII. *PLEURONECTIDÆ.*



THE LEMON SOLE.

THE FRENCH SOLE, *Sussex coast.*

Solea pegusa, Lemon Sole, YARRELL, Zool. Journ. vol. iv. p. 467, pl. 16.
,, ,, ,, ,, JENYNS, Man. Brit. Vert. p. 467, sp. 155.

DURING a short visit to Brighton in the last week of February 1829, I obtained a single example of this species of Sole, which appeared to have been previously unnoticed as occurring on our shores. Since it was described in the Zoological Journal, as above quoted, I have obtained, but at considerable intervals, two or three other specimens of this fish in the London market, and have now deposited examples in the British Museum and the collection of the Zoological Society.

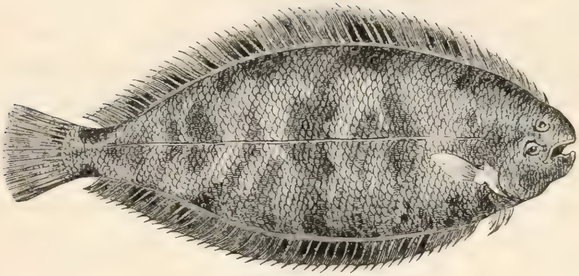
This species is occasionally taken with the common Sole when trawling over a clear bottom of soft sand, about sixteen miles from Brighton in a direction towards the coast of France; from which circumstance this fish is known to some of our fishermen by the name of French Sole; others call it by that of Lemon Sole, in reference to its prevailing yellowish colour, and on the Devonshire coast it is called the Sand Sole. This species has since been taken in Belfast Bay, as recorded by Mr. William Thompson.

In shape the Lemon Sole is wider in proportion to its whole length than the common Sole, and it is also somewhat thicker; the head is smaller, being in proportion to the whole length of the fish rather less than as one to seven; the breadth of the body, dorsal and anal fins included, exactly half the whole length: the arrangement of the fins is nearly the same as in the common Sole; but the fin-rays and the number of vertebræ differ.

D. 81 : P. 8 : V. 5 : A. 69 : C. 17. Vertebræ 43.

The prevailing colour is a mixture of orange and light brown, freckled over with numerous small round spots of dark nutmeg brown, giving a mottled appearance to the whole upper surface. The scales differ in character; the lateral line is straight, but not so prominent or strongly marked; the tail is narrower than in the common Sole, though containing the same number of rays; the end of the pectoral fin spotted with black. On the under side the appearance is still more characteristic of the distinction of the species. The under surface of the head is almost smooth, without any of the papillary eminences so numerous and remarkable in the common Sole, and the nostril is pierced in a prominent tubular projection, which is wanting in the other: the under surface is white with the appearance of the scales more strongly marked than upon the upper.

SUBBRACHIAL MALACOPTERYGII. *PLEURONECTIDÆ.*



THE VARIEGATED SOLE.

Pole panachée, Duhamel, sect. ix. pl. 2, fig. 3.
Pleuronectes lingula, Redbacked Flounder, Penn. Brit. Zool. vol. iii. p. 313, pl. 49.
,, *variegatus, Variegated Sole,* Don. Brit. Fish. pl. 117.
Solea variegata, ,, ,, Flem. Brit. An. p. 197, sp. 102.
Monochirus variegatus, Thompson, Ann. Nat. Hist. vol. ii. p. 404.

Monochirus. *Generic Characters.*—The pectoral fin on the upper or eye side small; that on the under side minute, almost imperceptible, or entirely wanting: in other respects like *Solea.*

The Variegated Sole appears, like the Lemon Sole last described, to be a rare species, and but few specimens are to be found in collections, though it seems to have a wide range. According to Professor Reinhardt, it is found on the shores of Scandinavia. In the Magazine of Natural History, conducted by Mr. Loudon, a notice appears, vol. vi. page 530, that it has been taken at Rothsay. Mr. Donovan obtained one seven inches long in the London market. Colonel Montagu mentions that Dr. Leach bought three in

Plymouth market in August 1808, and gave him one of them, measuring nine inches in length, from which his notes of the species were recorded in his MS.; and Mr. Couch has observed it in Cornwall, very kindly sending me a specimen, from which the woodcut was executed. But little is known of the habits of this species; but it is stated in Pennant that it appears about Plymouth in the spring. It has since been found by Mr. William Thompson in Belfast Bay.

It is immediately distinguished from either of the Soles previously described here, by its variegated colour; by its scales, which are larger; by its pectoral fins, which are much smaller, that on the under side being very minute; and by the dorsal and anal fins, as shown in the cut, ending considerably short of the tail.

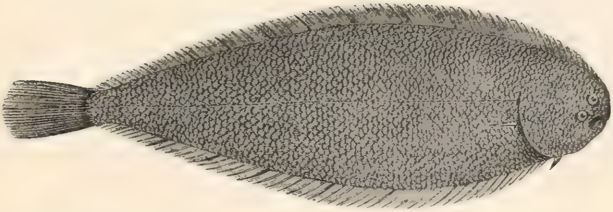
The whole length of the specimen described was five inches; the breadth without the fins, one inch and three-eighths; the length of the head compared to that of the body alone, as one to four: the dorsal and anal fins ending on the same plane, but not reaching the base of the caudal rays, and both having the numerous rays projecting beyond the edges of the connecting membranes, as shown in the cut; the right pectoral fin small, that on the under side consisting only of two unequal, slender, and short rays.

The fin-rays in number are—

D. 67 : P. right side 4 : left side 2 : V. 5 : A. 52 : C. 16.

The body is thicker in proportion than either of the Soles previously described; the scales larger, the divisions strongly marked, the edges ciliated, rough to the touch; the lateral line straight: the colour of the upper side reddish brown, clouded both on the body and fins with darker brown; the under surface white; scales also ciliated and harsh to the touch.

SUBBRACHIAL MALACOPTERYGII. *PLEURONECTIDÆ.*



THE SOLENETTE,

OR LITTLE SOLE.

Monochirus linguatulus,	Cuvier, Règne An. t. ii. p. 343.
Solea parva sive lingula,	Rondeletius, p. 324.
La petite Sole,	,, French Edit. Lyons, p. 260.
Solea parva sive lingula Rondeletii,	Willughby, p. 102, F. 8, fig. 1.
Pleuronectes lingula,	Linn. Syst. Nat. p. 457, sp. 10.
Solenette,	Duham. sect. ix. pl. 2, fig. 1 & 2.
Solea lingula,	*Red-backed Sole,* Jenyns, Brit. Vert. p. 468.
Monochirus minutus,	Parnell, Mag. Zool. and Bot. vol. i. p. 527.
,, *linguatulus,*	Thompson, Ann. Nat. Hist. vol. ii. p. 405.

At the time of writing the description of the Variegated Sole for the first edition of the British Fishes, vol. ii. p. 262, I had not seen a specimen of the true *Solea parva sive lingula* of Rondeletius, and I find that I then included two distinct species in the synonymes employed to designate the Variegated Sole. The Rev. L. Jenyns, in his Manual of British Vertebrate Animals, appears to have suspected that there was a fourth species of Sole on our coast, since, at the conclusion of the description of his third species, he has observed, " further observation is necessary in order to decide whether, in this instance, I have confounded two nearly allied species."

In the published proceedings of the Royal Society of Edinburgh for January 1837, Dr. Parnell has figured and briefly described, under the name of *Monochirus minutus*, a small species of Sole obtained by him at Brixham on the Devonshire coast, which appears to be the true *Solea parva sive lingula* of Rondeletius. This small fish is at once distinguished from the Variegated Sole of Donovan, and other English authors, by the tapering of the body towards the tail, and more particularly by the dorsal and caudal fins being united to the base of the tail, which is not the case in the Variegated Sole. This union of the two fins with the tail is shown in the figure given by Rondeletius, and again by Willughby, as referred to.

Dr. Parnell has obtained several examples of this interesting little species, which is not unfrequently taken in the trawl-nets by the fishermen of Brixham, but on account of its diminutive size it is seldom brought on shore. It has evidently been confounded with the Variegated Sole; but, independently of other distinctions, the Variegated Sole has the tail separated from the dorsal and caudal fins by a considerable interval.

The Variegated Sole of Donovan and of Montagu's MS. the Red-backed Flounder of Pennant's Zoology, and the Variegated Sole of Dr. Fleming, are so many specimens of the truly Variegated Sole, and are each of them quite distinct from the true *lingula*. Duhamel appears to have distinguished and figured both species. Mr. Thompson has obtained both species on the coast of the North of Ireland, and by his kindness I have now his specimens before me for comparative examination. Dr. Parnell has given me two examples of his *Monochirus minutus*, which, as before observed, I believe to be the true *Solea parva sive lingula* of Rondeletius; and I have also two specimens of the true Variegated Sole; one of these, from which the figure in the

British Fishes was drawn, has the dark clouded variation in colour extending, as in Donovan's figure, over the back as well as the fins: in a specimen belonging to Mr. Thompson, in one of my own, and in Montagu's specimen, as described in his MS. the dark variations in colour are confined to patches on the fins, as in Pennant's figure; but without reference to colour, this species is immediately known by the space which occurs between the two elongated fins and the tail, which Montagu says was equal to half an inch in his specimen, which measured nine inches.

Both these species belong to the genus *Monochirus* of Cuvier, distinguished from those of the genus *Solea* by the very small size of the upper pectoral fin, and the very rudimentary state of the pectoral fin on the under side, which is, indeed, sometimes entirely wanting. Of our two British species of *Monochirus*, the *M. linguatulus* of Cuvier has the smaller upper pectoral fin of the two, as observed by Mr. Thompson, who has, in the second volume of the Annals of Natural History, published some interesting details on the two British species of the genus *Monochirus*.

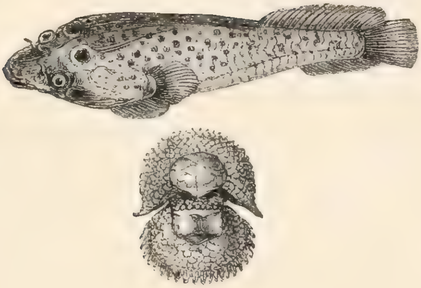
From the numbers of these small Soles which are taken in the trawl-nets off Brixham throughout the whole year, says Dr. Parnell, and from their never appearing to attain a large size, there can be but little doubt but that they are arrived at their full growth. The fishermen, who appear perfectly familiar with their appearance, call them Red Soles; and scarcely a trawl-boat leaves Brixham Harbour that does not capture a dozen or more of these fish daily; but, from their diminutive size, they are either thrown overboard, or left to decay at the bottom of the vessels.

Description:—"Length five inches; the width at the upper third nearly two inches: the colour of the back light reddish brown, the under surface pale white; every sixth or seventh ray of the dorsal and anal fin black. In shape this fish is similar to the common Sole, but is of a more wedge-shaped form, becoming narrow at the caudal extremity. The head is small, one-sixth of the whole length ; the mouth is crooked ; each jaw is furnished with a number of minute teeth, placed close together, and extending but half way round the mouth ; the eyes are small ; the upper, or left eye, a little in advance. The dorsal fin commences immediately over the upper lip, and runs down the back, to be connected with the caudal rays ; the anal fin begins under the posterior margin of the operculum, and continues to the tail. The number of the fin-rays are,—

D. 73 : P. 4 : V. 4 : A. 54 : C. 14.

The scales are small, with from twelve to fifteen denticles at their free extremity, rendering the whole surface of the fish rough to the touch when the finger is passed along from the tail to the head. The pectoral fin, on the eye-side, is small, with the lower half black, while the fin on the opposite side is very minute, and of a pale white ; the lateral line is straight throughout ; the tail is rounded at the end, and mottled with brown."

SUBBRACHIAL MALACOPTERYGII. *CYCLOPTERIDÆ.**



THE CORNISH SUCKER.

Lepidogaster Cornubiensis,	*Cornish Sucker,*	Flem. Brit. An. p. 189, sp. 71.
Cyclopterus Lepidogaster,	*Jura Sucker,*	Penn. Brit. Zool. vol. iii. p. 181, pl. 25.
,, *ocellatus,*	*Ocellated Sucker,*	Don. Brit. Fish. pl. 76.
Lepidogaster biciliatus,	,, ,,	Risso, Hist. tom. iii. p. 272, sp. 163.
,, *Cornubiensis,*	*Cornish Sucker,*	Jenyns, Man. Brit. Vert. p. 469, sp. 157.

Lepidogaster. *Generic Characters.*—Body smooth, without scales; dorsal and anal fins opposite, and near the tail; pectoral fins large, descending to the inferior surface of the body, and by an extension of the membrane surrounding an oval disk; ventral fins united by a membrane which extends circularly under the belly, forming a second concave disk.

Baron Cuvier has called the third family of the Subbrachial Malacopterygii, *Discoboles*, on account of the disk formed by the union of the ventral fins. The term Cyclopteridæ, derived from an original Linnæan generic name, is here adopted in order to preserve uniformity in the names of the families. The pectoral fins in these fishes are large, descending to the inferior surface of the body, where they are joined by four strong rays, and, united by a membrane to a similar structure on the opposite side, form the boundary of an adhesive disk. In the species of the first genus, a second disk is formed by the union of the ventral fins.

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* The family of the Sucking-fishes.

The few species belonging to this small family are very remarkable for the power they possess of attaching themselves to stones, rocks, or other substances, by means of the adhesive apparatus on the under surface of their bodies, apparently deriving some degree of protection and support from the contact.

The two British species belonging to the first genus are small, defenceless, their bodies smooth, without scales; and the power of attaching themselves to stones, &c. which they are seen to exercise, may be useful by enabling them to resist the action of strong currents or dashing waves, and is perhaps applicable with them to other uses, with which naturalists are not yet acquainted.

The first prettily-marked species of Sucking-fish was discovered by Dr. Borlase, who found it on the coast of Cornwall, and described it under the name of the Lesser Sucking-fish, in his Natural History of that county. Pennant afterwards found it at Jura, in the Hebrides, and called it in consequence the Jura Sucker; but if any name indicative of a peculiar geographical locality is admissible, it ought to have been that only in which it was first discovered; and I have therefore followed Dr. Fleming and Mr. Jenyns in calling it the Cornish Sucker, although this name is not entirely free from objection, two other species of fishes, provided with suckers, being found in Cornwall. Mr. Couch says, however, that this fish is there called pre-eminently the Sucking-fish by fishermen, from the readiness with which it adheres to any substance, and even to the hand that seizes it,—a circumstance which has also been noticed by Colonel Montagu. "It is sluggish in its habits; but seems to wander, since it is sometimes abundant, and at others rare. Its usual haunts are about low-water mark, where it is often left by the tide, concealed beneath a stone. I find it," says Mr. Couch, "large with spawn in March. Its food is crustaceous animals and marine insects, which it swallows entire."

This species has also been found on the coasts of Antrim and Clare in Ireland.

The whole length of the specimen described was two inches and a half; the distance from the point of the nose to the end of the gill-cover was equal to one-third of the whole length of the fish: the head depressed; mouth produced; very much flattened; narrower than the head; has been aptly called spatula-like; gape elongated: numerous small teeth in both jaws, forming a band in each: under surface of the head very flat; the first disk before the line of the opening of the gill-cover; the second disk behind it: upper surface of the head smooth; before the inner corner of each eye a small flattened filament, about equal in length to the diameter of the eye itself; behind this a second, but much shorter: both of a bright carmine colour; behind the eyes, which are widely separated, are two distinct, red, eye-like spots: the dorsal fin commences about half-way between the eyes and the end of the tail; the anal fin begins still nearer the tail, and both are joined to it by a membrane; the tail rounded; the posterior part of the body compressed. The pectoral fin large, with an extension underneath of four stronger rays, which with the connecting membrane form the sides of the most anterior disk of the two; an extension of the membrane only, without rays, being continued along the front. Immediately behind the broad swimming portion of the pectoral fin on each side, a membrane arises in the same vertical position, which joining the united ventral fins forms the free edge of the second disk, the rays of the two ventrals occupying the posterior portion, and the continuation of the connecting membrane making the circle entire.

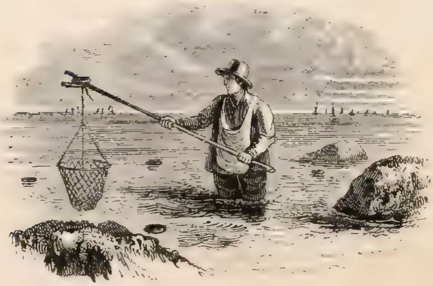
The fin-rays in number are—

D. 18 : P. 19 : A. 10 : C. 18.

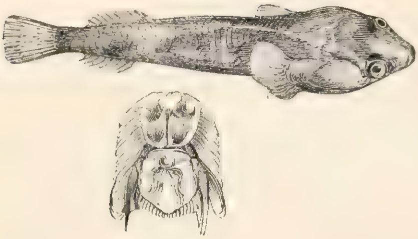
The general tint a pale flesh colour with spots and patches of carmine about the upper and under surface of the jaws, around the eyes, on the top of the head, sides of the body and abdomen. The description was taken from the largest of five specimens, on three of which the spots behind the eyes were conspicuous, but wanting in the other two.

The appearance of the surface of the disk is shown in the woodcuts of some of the more closely allied species, to assist in determining specific distinction.

The vignette below represents a man fishing for prawns on a rocky coast. The fisherman deposits around him eight or ten hoop-nets, each baited with a piece of stale fish : a large bung by way of a buoy is attached to each hoop. The man, with a long forked stick raises the nets in succession, by putting the fork of the stick under the bung, and deposits them again after examination.



SUBBRACHIAL
MALACOPTERYGII. *CYCLOPTERIDÆ.*



THE BIMACULATED SUCKER.

Lepidogaster bimaculatus, *Bimaculated Sucker*, Flem. Brit. An. p. 190, sp. 72.
Cyclopterus ,, ,, ,, Penn. Brit. Zool. vol. iii. p. 182, pl. 25.
,, ,, ,, ,, Don. Brit. Fish. pl. 78.
,, ,, ,, ,, Montagu, Linn. Trans. vol. vii. p. 293.
Lepidogaster ,, ,, ,, Jenyns, Man. Brit. Vert. p. 470, sp. 158.

This very distinct species was first described by Pennant from a specimen sent him by the Duchess of Portland, which was taken at Weymouth. It has since been taken by Mr. Donovan on the coast of Kent; by Professor Henslow at Weymouth; by Colonel Montagu in Devonshire, and at two different localities in Cornwall, Polperro and Penzance. It has also been taken by Mr. William Thompson of Belfast, when dredging in deep water for shells on the eastern and western coasts of Ireland.

Colonel Montagu obtained it by deep dredging at Torcross, adhering to stones and old shells, and kept some specimens alive for a day or two in a glass of sea-water.

" In this situation they always adhered to the sides of the glass by the apparatus termed the sucker, and frequently remained fixed till they died ; and even after death the power of adhesion continues ; the wet finger being applied to the part, the fish becomes suspended : when alive they instantly attach themselves to the hand if taken out of the water."

Mr. Couch says it keeps in deeper water than the preceding species ; but is occasionally found under stones at low-water mark.

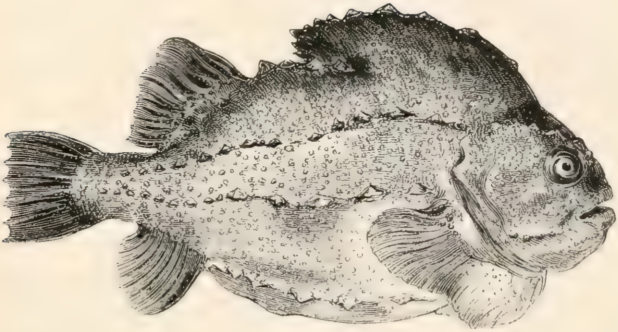
In this species, of which I possess several examples, varying in length from three-quarters of an inch to one inch and three-quarters in length, the head is depressed ; the posterior portion of the body compressed ; the head is shorter, compared to the whole length, than in the preceding species : the mouth wider, but the jaws not so much produced ; the teeth similar ; no filaments before the eyes ; the irides pink and gold ; the pupils blue : the additional rays at the inferior part of the pectoral fin, and the connecting membrane on each side, making up the lateral portions of the anterior disk, are much longer : the ventral fins form the sides of the second or posterior disk, and are also elongated ; the dorsal and anal fins of equal size, opposite, short, placed far back ; commencing and ending on the same planes : not connected with the tail, between which and the two fins just named there is a considerable space : tail rather elongated.

The fin-rays in number are—

D. 6 : P. 19 : A. 6 : C. 10.

The general colour carmine red ; pale flesh-colour underneath, with a light-coloured patch between the eyes, and otherwise liable to some variation in the markings : the two spots on the sides not always very obvious ; young specimens are without these lateral markings.

SUBBRACHIAL MALACOPTERYGII. *CYCLOPTERIDÆ.*



THE LUMP SUCKER.

SEA-OWL, *and* COCK PADDLE.

Cyclopterus lumpus, Linnæus. Bloch, pt. iii. pl. 90.
" " Cuvier, Règne An. t. ii. p. 346.
Lumpus Anglorum, Willughby, p. 208, N. 11.
Cyclopterus lumpus, *Lump Sucker,* Penn. Brit. Zool. vol. iii. p. 176, pl. 24.
" " " " Don. Brit. Fish. pl. 10.
" " *Lump-fish,* Flem. Brit. An. p. 190, sp. 75.
" " *Common Lump-Fish,* Jenyns, Brit. Vert. p. 471.

Cyclopterus. *Generic Characters.*—Head and body deep, thick, and short; back with an elevated ridge, the investing skin enclosing simple rays; pectoral fins uniting under the throat, and with the ventrals forming a single disk.

The Lump Sucker is remarkable for its very grotesque form, while from the large size of its body, both as to depth and thickness in reference to its length, and the comparatively small size of its fins, it appears calculated to make but slow progress through the water.

It is more plentiful northward than on our southern coast, and beyond this country has a most extensive range. Pennant includes it in his Arctic Zoology. It is caught on the coast of Greenland, where it is eaten; and the Lump Sucker of the North American shores is apparently identical with our own. Professors Nilsson and Reinhardt include it among the fishes of Scandinavia; and Mr. Low considers it common in the Orkneys. Dr. Neill says that in the spring months it is caught on the sands of Portobello, and sent for sale to the Edinburgh market, where it is purchased for table, and the male fish considered superior to the female. "If," says Dr. Richardson, "the authority of Sir Walter Scott is to pass current in gastronomy, the Lump, or Cock-paidle, as it is named in Scotland, is a fish of good quality, for he makes Mr. Oldbuck give the same price for one that he does for the Bannock-fluke, or Turbot. The epithet of Cock-paidle seems to have originated in the appearance of the elevated dorsal ridge, which is enveloped, like the rest of the fish, in a thick, tuberculated skin, with some resemblance to the comb of a domestic cock." Along our eastern and southern coasts it is also taken more exclusively during spring, when it approaches the shore for the purpose of depositing its spawn, which happens in April or the beginning of May. This species has also been taken in various parts of Ireland.

Some of our fishermen consider that we have on our coast two species of Lump-fish, which they distinguish by the names of Red-Lump and Blue-Lump, considering the first only as eatable; but the difference in colour, and also in the quality of the flesh, is only the effect of season; the fine external colour, as well as the firmness of the flesh, being lost to the fish for a time by the exhausting process of spawning; it is then by them considered as the worthless Blue-Lump. The ova forming the hard roe are of large size, and of a fine reddish-orange colour.

"Fabricius describes the Lump-fish as approaching the rocky bays on the Greenland coast in the months of April and May for the purpose of spawning. The female precedes, and deposits her roe among the larger algæ, and in fissures of the rocks ; the male shortly follows, and fructifies the eggs, adhering so closely to the mass of roe, that the impression is left upon the hollow surface of the shield formed by the ventrals ; after which he keeps watch over the sacred deposit, and guards it from every foe with the utmost courage. If driven from the spot by man, he does not go far, but is continually looking back, and in a short time returns. Even the well-armed Wolf-fish hazards his life if he approaches the Lump's nest ; for this creature, notwithstanding the smallness of its teeth, is capable of attaching itself to its adversary's neck, and inflicting thereon a mortal wound." This account by Fabricius has been doubted by Lacépède, but in part receives confirmation from the observations of others. Dr. George Johnston, in his list of the fishes of Berwickshire, says, "The Cock and Hen Paidle spawn toward the end of March and in April. At that season the Hen approaches the shore and deposits her spawn among the rocks and seaweed within low water mark, and immediately afterwards returns to deeper water. The male then covers the spawn, and, according to the testimony of our fishermen, remains covering it, or near it, until the ova are hatched. The young soon after birth fix themselves to the sides and on the back of their male parent, who sails, thus loaded, to deeper and more safe retreats. He is only half the size of the Hen ; and at the breeding season his belly becomes of a reddish colour. The spawn of a single female will fill a large basin, and is of a beautiful pink colour : the eggs globular, and about the size of swan shot. Not in use as food, but the Cock especially is reported to be excellent when fried or baked."

The young are four inches and a half long, and three inches in height by the end of November. Shaw's specimen, of six inches in length, to which he attached the specific name of *Pavonina*, is only a young fish of our common species, which for want of sufficient age had not attained its perfect colour. The bony rays supporting the dorsal crest frequently pierce through the skin, and giving the appearance of two dorsal fins, have suggested the notion of another species; the young have also, from differences depending upon their age and condition as fry, been considered specifically distinct, and thus the terms *pyramidalis*, *minutus*, and two or three other names have arisen. As the Lump-fish is retentive of life, its power of adhesion is sometimes made the subject of experiment. Pennant says, "That on placing a fish of this species, just caught, into a pail of water, it fixed itself so firmly to the bottom, that on taking it by the tail, the whole pail by that means was lifted, though it held some gallons, and that without removing the fish from its hold."

The Lump-Sucker feeds principally on young fish, of which it devours a large quantity. Mr. Couch says that it sometimes takes a bait, and he has found in its stomach various *onisci*.

In the month of March the colours of the Lump-fish are in the highest perfection, combining various shades of blue, purple, and rich orange; it is then frequently to be seen in the shops of London fishmongers, suspended by the middle of the back, attracting attention from the combination of singular form and brilliant colours.

A specimen sixteen inches long is usually about eight inches deep, and four inches wide: the length of the head is about one-fourth of the whole length of the fish; the descending line of the profile of the head is abrupt; the back highly arched and somewhat compressed, forming a ridge, with a row of tubercles along the upper edge; on cutting through the integument, the ridge is found to be supported by several rays, which sometimes from abrasion of the hard skin appear externally, and have been considered as bearing some resemblance to an anterior dorsal fin. Behind this central ridge, and over the last third portion of the curve of the dorsal line, is the true dorsal fin, the length of the base of which is about equal to the length of the longest of its rays; the pectoral fins descend low on the sides, and passing forwards enclose the adhesive apparatus which extends anteriorly to the edge of the membrane connecting the branchiostegous rays, and backwards as far in a vertical line as the posterior angle of the operculum: the union of the ventral fins complete the single disk of the only species of this genus that inhabits our seas. The anal fin is under or opposed to the dorsal, and of nearly the same size and shape; the tail moderate.

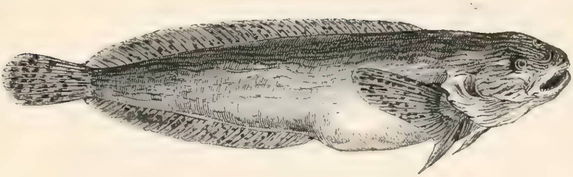
The fin-rays in number are—

D. 11 : P. 20 : A. 9 : C. 10.

Each of the rays with a row of hard tubercles along a considerable portion of their length. The whole surface of the head and body is covered with small bony tubercles, most of which are more or less stellated in form. Along several parts of the body are rows of larger and more prominent tubercles, with surfaces minutely granulated; one row occupies the central ridge of a portion of the back; two or three tubercles are placed on each side just in advance of the dorsal fin; one long row extends from the upper angle of the operculum in a straight line to the upper part of the end of the fleshy portion of the tail; a second long row reaches from the space above the pectoral fin to the lower part of the fleshy portion of the tail; another row of large size extends along the abdomen on each side as far as the commencement of the anal fin.

The mouth is wide; the lips fleshy; the lower jaw the longest: a band of short and small teeth in each jaw: a small patch of rounded teeth on the root of the tongue, with others at the pharynx: the irides a fine red; the colour of the sides of the head and body, and all the upper parts, varying shades of dark blue, lighter blue, and purple; the lips, under surface of the head and body, fine rich orange; all the fins tinged with the same colour. After the season of spawning is over, much of the brilliant colouring is lost for a time.

SUBBRACHIAL MALACOPTERYGII. *CYCLOPTERIDÆ.*



THE UNCTUOUS SUCKER,

OR, SEA-SNAIL.

Liparis vulgaris,	*Sea Snail,*	Flem. Brit. An. p. 190, sp. 73.
,, ,,	Cuvier, Règne An. t. ii. p. 346.	
,, *nostras,*	*Sea Snail,*	Willughby, App. p. 17, H. 6, fig. 1.
Cyclopterus liparis,	Linnæus. Bloch, pt. iv. pl. 123, fig. 3.	
,, ,,	*Unctuous Sucker,* Penn. Brit. Zool. vol. iii. p. 179, pl. 24.	
,, ,,	,, ,,	Don. Brit. Fish. pl. 47.
,, ,,	*Common Sea Snail,* Jenyns, Brit. Vert. p. 473.	

Liparis. *Generic Characters.*—Body without scales, smooth, elongated, compressed posteriorly; a single dorsal fin rather lengthened: ventral fins united to the pectorals, and surrounding a single disk.

The Unctuous Sucker, or Sea-Snail, so called from the soft and slimy surface of its body, appears to be much more common in the northern parts of the British Islands than in the southern. Mr. Scoresby, and other observers, have even found it as far north as Nova Zembla and Greenland; and specimens of it were taken in the trawl-net on the west coast of Davis's Straits during the first Arctic voyage of Captain Sir Edward Parry.

This species is found on the Berwickshire coast; and Dr. Parnell has obtained specimens in the Frith of Forth.

Mr. Low says, "The Sea-Snail is found under stones at many places in Orkney; but in no place more frequently than that at the point of the Ness of Stromness, where they may be picked up by dozens." Yet it does not appear to be mentioned by Professor Nilsson or Reinhardt in their accounts of the fishes of the Scandinavian shores; nor is it included by Linnæus in his *Fauna Suecica.*

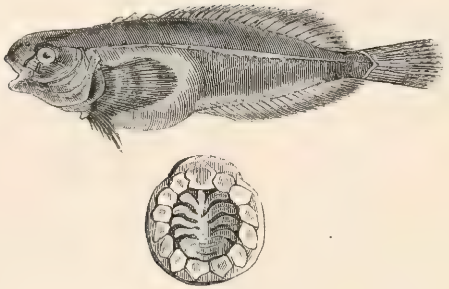
Mr. Donovan obtained a specimen from among a parcel of Sprats at Billingsgate fish-market: and those who recollect the wholesale mode of fishing for Sprats practised by the Stow-boatmen, as described at page 199, will not be surprised that many rare and curious fishes of small size are caught with the Sprats. It is also obtained on the southern coast, under stones, and in small pools of water left by the ebbing tide. Dr. Mac Culloch says this species ascends rivers from the sea to deposit its spawn, and it is frequently found near the mouths of rivers. Pennant says it is full of spawn in January, and the matured ova are said to be very large. It feeds on aquatic insects, testaceous animals, and very small fishes.

The whole length of the specimen described was four inches, which is the common size of the adult of this species; but it is said to grow much larger in the Northern Seas: the head is about one-fourth of the whole length of the fish; the eyes widely separated, the space between them depressed; the nose blunt; the lips thick and fleshy; the mouth wide, but not deeply divided. Mr. Low says it has no teeth; but this is an oversight; the teeth are very numerous, and small, with minutely recurved points, forming a broad rasp-like band in each jaw; the tongue also broad, covered with prominent papillæ; the lower jaw rather the longest; the gill-opening placed high up; the form from the shoulder is compressed, and tapering all the way to the tail; the body invested with a thin semi-transparent membrane, which encloses it like a bag, the fixed points being the lines of the dorsal and anal fins; the pectoral fins are large, and the lower portions descending the side are attached to additional rays like ventral fins, which extending far forward are situated exterior to the sides of the adhesive disk; the belly tumid; the dorsal fin begins much nearer the head than the anal fin, and both end close to the tail; the caudal rays rather long and narrow. The fin-rays in number are—

D. 36 : P. & V. 32 : A. 26 : C. 12.

The colour of the body is a pale brown, irregularly striped with lines of a darker colour, which take different directions, and give a variegated appearance to the head, back, and sides; these lines are confined to the outer thin skin, and do not appear upon the more solid surface underneath; in this state some authors have called this species *lineatus;* but these markings are not constant, and many examples are without any streaks or lines, the edges of the dorsal and anal fins only being edged with a darker colour; the tail, and sometimes the pectoral fins, slightly barred and spotted. When kept in diluted spirit of wine, the coloured lines and characters of the species may be easily preserved; but this fish loses both markings and size if allowed to become dry.

SUBBRACHIAL
MALACOPTERYGII. *CYCLOPTERIDÆ.*



MONTAGU'S SUCKING-FISH.

DIMINUTIVE SUCKER.

Liparis Montagui,	*Montagu's Sucker,*	FLEM. Brit. An. p. 190, sp. 74.
,, ,,		CUVIER, Règne An. t. ii. p. 346, note 2.
Cyclopterus Montagui,	*Diminutive Sucker,*	MONTAGU, Wern. Mem. vol. i. p. 91, pl. 5.
,, ,,	,, ,,	DON. Brit. Fish. pl. 68.
,, ,,	*Montagu's Sucker,*	PENN. Brit. Zool. vol. iii. p. 183.
,, ,,	*Sea Snail,*	JENYNS, Brit. Vert. p. 473.

THIS species of Sucking-fish, smaller in size than the one last described, was first discovered by Colonel Montagu. A drawing of it was sent by that excellent observer to Mr. Donovan, who was then publishing his Natural History of British Fishes, and with whom the specific name, referring to Colonel Montagu, originated. The first specimen obtained was of very diminutive size. Subsequently Colonel Montagu having acquired various other larger and adult specimens, published a description and figure of this species himself in the Memoirs of the Wernerian Natural History Society, as already quoted.

This fish has since that period been found on various parts of the coast. Dr. George Johnston has obtained it in Berwick Bay; Mr. Thompson has taken it on the south-western coast of Scotland, and in Belfast Bay; it has also been taken in the south of Ireland, and it is not uncommon in Cornwall, as well as on the Devonshire coast.

Colonel Montagu says this species inhabits only the rocky parts of the coast, and of course is rarely taken with the dredge. Those obtained by its discoverer were found at exceedingly low tides among the rocks at Milton, on the south coast of Devon. When it is adhering to a rock the posterior part of the body is frequently turned to one side, nearly parallel with the anterior part, the tail being brought close to the head. This habit of curving its body has been observed by all those who have found this species.

Mr. Couch's notice of it in his MS. is as follows:—"This is a common species in the West of England, where, however, it seems to wander, since at certain times it is much more rare than at others. It possesses considerable activity; and when the tide has ebbed it is often found concealed beneath a stone, where when at rest it usually throws the tail forwards towards the head. I have never seen it adhere to any fixed substance. The young come to life in September."

Montagu's Sucker, in the adult state, is from two inches and a half to three inches long: the body is rounded as far as the vent; the posterior end somewhat compressed; head broad, a little depressed, and inflated about the gills; mouth moderately large; both jaws armed with several rows of minute teeth: eyes small, and placed high; irides golden; pupils dark blue, with a single blue line descending from the eye to the angle of the mouth: the operculum angular; the branchiostegous membrane transparent; the pectoral and ventral fins unite; the first is rounded; in the last, four or five rays on each side invest the adhesive disk, which is single, small, and circular: an enlarged representation of the Sucker is here added to assist in affording the means of determining the species: the belly is very tumid; the vent far removed behind the sucker. The dorsal fin commences farther from the head than in the last species; the most anterior rays short, but gradually increasing in length form a broad fin towards the tail, where it is rounded: the anal fin shorter than the dorsal. The fin-rays in number are—

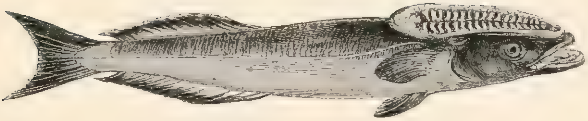
D. 26 : P. & V. 29 : A. 24 : C. 12.

This description is partly obtained from Montagu's paper.

The prevailing colour is a dull orange, varied with occasional bluish tints; the fins brighter orange red; the lateral line perceptible by a lighter-coloured streak; the under parts of the body, and about the throat and sucker, white, tinged with flesh colour.

SUBBRACHIAL MALACOPTERYGII.

ECHENEIDÆ.



THE COMMON REMORA.

Echeneis remora, Sucking-fish, Turton, Brit. Faun. p. 94, sp. 38.
,, ,, *Le Remora,* Bloch, pt. v. pl. 172.
,, ,, ,, Cuvier, Règne An. t. ii. p. 347.
,, ,, *Mediterranean Remora,* Penn. Brit. Zool. vol. iii. App. p. 524.
,, ,, *Common* ,, Jenyns, Man. Brit. Vert. p. 473, sp. 162.

Echeneis. *Generic Characters.*—Body elongated, covered with very small scales ; a single dorsal fin placed opposite the anal ; the head very flat, covered with an oval disk formed by numerous transverse cartilaginous plates, the edges of which are directed backward ; the mouth wide, with numerous small recurved teeth on both jaws, the tongue, and the vomer.

Dr. Turton in his British Fauna includes this species of Sucking-fish, having taken a specimen himself at Swansea from the back of a Codfish in the summer of 1806.

The species of this singular family are not numerous: Cuvier enumerates but four that are as yet made known, and another large West Indian one has been more recently described. They are immediately recognized by the flattened, oval, adhesive disk, on the top of the head, by means of which they are able to attach themselves firmly to the surface of other fishes, or the bottoms of vessels; but whether for protection or conveyance, or both, is a question which has not been satisfactorily ascertained.

The Greeks and Romans were well acquainted with the Mediterranean species, which is the fish under present consideration.

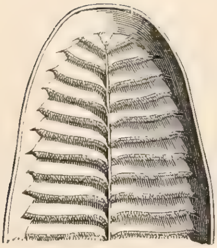
The length of the head, from the end of the upper jaw, which is much the shortest, to the end of the operculum, is nearly one-fifth of the whole length of the fish; the depth of the body about one-seventh of the whole length: the form of the head is flattened, very much depressed; the body about the middle nearly round in form, the posterior half compressed; the mouth is wide; the opening nearly horizontal, with two bands of minute teeth in the elongated lower jaw, a single band on the upper jaw, with others on the tongue and vomer, all curving inwards: the eye placed about half-way between the point of the upper jaw and the rounded end of the operculum; the gill-aperture very large; the adhesive disk in this species contains seventeen or eighteen transverse laminæ, divided by a longitudinal mesial ridge; the disk commences just behind and above the upper lip, and extends nearly as far back as the line of the ends of the pectoral fin-rays: all the fins are covered with a dense membrane, which imparts to them the consistence of leather; the pectoral fins are rather small and rounded; the ventrals narrow, very close together, the inner ray of each attached to the central line of the belly by a membrane; the dorsal and anal fins are both placed behind the mid-length of the fish, beginning and ending on the same plane; the end of the caudal rays crescent-shaped.

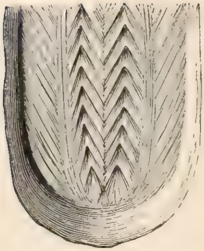
The fin-rays in number are—

D. 21 : P. 22 : V. 4 : A. 20 : C. 20.

The colour is dusky brown; the under part of the body rather lighter than the back; the fins darker in colour than the body.

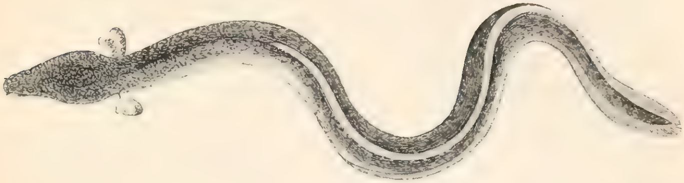
The disk of the adhesive apparatus in the specimen now described with seventeen transverse laminæ was one-third of the whole length of the fish, not including the caudal rays; the breadth one inch and one quarter. The figure on the left side of the vignette represents the outer surface of the anterior half of the disk: the margin is free, flexible, and of considerable breadth, to secure perfect contact with the surface to which it is opposed; the parallel laminæ are represented as only slightly elevated; the degree of adhesion is in proportion to the power used to raise the inner surface of the disk in a direction perpendicular to the plane of contact. The figure on the right side of the vignette represents the inner surface of the posterior half of the disk. The vertical direction of the moveable laminæ is effected by sets of muscles going off obliquely right and left from two elongated bony processes, one on each half of each of these moveable divisions. The contraction of these muscles, acting upon these levers, raises the external edges of the parallel divisions, increasing the area of the vacuum; and it will be observed that the points of the moveable transverse divisions to which the muscles are attached are nearer the middle line than the outer edge, by which the chance of interfering with the perfect continuity of the free margin, and thereby destroying the vacuum, is diminished. All the bony laminæ, the outer edges of which are furnished with rows of minute tooth-like projections, are moved simultaneously, like the thin vertical divisions of our common wooden window-blinds by means of the mechanical contrivance on the frame-work. The longer muscles placed nearer the outer oval edge are probably instrumental in preserving the contact of the more flexible margin, and the serrated external edges of the parallel laminæ help to preserve the degree of elevation obtained: the adhesive power, as before observed, is in proportion to the area of the vacuum.





APODAL
MALACOPTERYGII.

MURÆNIDÆ.



SHARP-NOSED EEL.

Anguilla acutirostris,	*Sharp-nosed Eel,*	Yarrell, Proceed. Zool. Soc. 1831, pp. 133 and 159. Zool. Journ. vol. iv. p. 469.
,, *omnium autorum,*		Willughby, p. 109, G. 5.
,, *acutirostris,*	*Sharp-nosed Eel,*	Jenyns, Man. Brit. Vert. p. 474, sp. 163.
Muræna anguilla,	*L'Anguille,*	Linnæus. Bloch, pt. iii. pl. 73.
,, ,,	*Common Eel,*	Penn. Brit. Zool. vol. iii. p. 191.
Anguilla vulgaris,	,, ,,	Flem. Brit. An. p. 199, sp. 109.
,, ,,	*Long-bec,*	Cuvier, Règne An. t. ii. p. 349.
,, ,,	*Common Eel,*	Bowdich, Brit. Fr. Wat. Fish. No. 7.

Anguilla. *Generic Characters.*—Body cylindrical, elongated, covered with a thick and smooth skin; the scales very small; lubricated with copious mucous secretion; mouth with a row of teeth in each jaw, and a few on the anterior part of the vomer; pectoral fins close to a small branchial aperture; no ventral fins; dorsal fin, anal fin, and caudal fin united.

Baron Cuvier, in this family of the *Murænidæ*, or Eel-shaped Fishes, which includes several genera forming his fourth order, has brought together those fishes with soft fins which have an elongated form of body: they are also destitute of ventral fins, and are in consequence called *Apodal.* The genus *Anguilla,* including our common Eels, is the first of this order.

The general appearance of the Eel is so well known, and so unlike that of most other fishes, as to require but a slight description; yet it was not till a period of very modern date that naturalists became acquainted with the fact that the fresh waters of several countries produce three or four distinct species which had previously been confounded together. Thus the first edition of the *Règne Animal*, published in 1817, included but one species of common fresh-water Eel as well known: the second edition, published in 1829, contains a short notice of four different species; three of which, if not all four, are found in this country.

The form of the Eel, resembling that of the serpent, has long excited a prejudice against it, which exists in some countries even to the present time; and its similarity to snakes has even been repeated by those, who, from the advantages of education, and their acquirements in natural history, might have been supposed capable of drawing more accurate conclusions. There is but little similarity in the snake and the Eel except in the external form of the body: the important internal organs of the two animals, and the character of the skeleton, are most decidedly different.

Eels are in reality a valuable description of fish: their flesh is excellent as food; they are very numerous, very prolific, and are found in almost every part of the world. The various species are hardy, tenacious of life, and very easily preserved. In this country they inhabit almost all our rivers, lakes, and ponds; they are in great esteem for the table, and the consumption in our large cities is very considerable. The London market is principally supplied from Holland by Dutch fishermen. There are two companies in Holland, having five vessels each: their vessels are built with a capacious well, in which large quantities of Eels are preserved alive till wanted. One or more of these vessels may be constantly seen lying off Billingsgate; the others go to Holland for fresh supplies, each bringing a cargo of 15,000 to 20,000 pounds' weight of live Eels, for which the Dutch merchant pays a duty of 13*l.* per cargo for his permission to sell. Eels and Salmon are the only fish sold by the pound weight in the London market.

Eels are not only numerous, but they are also in great request, in many other countries. Ellis, in his Polynesian Researches, vol. ii. page 286, says, "In Otaheite, Eels are great favourites, and are tamed and fed until they attain an enormous size. These pets are kept in large holes, two or three feet deep, partially filled with water. On the sides of these pits they generally remained, excepting when called by the person who fed them. I have been several times with the young chief, when he has sat down by the side of the hole, and, by giving a shrill sort of whistle, has brought out an enormous Eel, which has moved about the surface of the water, and eaten with confidence out of its master's hand."

At a meeting of the Wernerian Natural History Society of Edinburgh, held in January last, Professor Jameson, P. in the chair. Mr. Walter C. Trevelyan read an account of the habits of some tame Eels. In a small pond in a walled garden at Craigo, the seat of David Carnegie, Esq. near Montrose, these Eels have been kept for nine or ten years. They lie torpid during the whole winter, except the sun be shining bright, when they will occasionally come out from their hiding-place under some loose stones, and sprawl about the bottom of the pond, but refuse to take any food. The 26th of April was the first day in 1840 that they rose for worms; but they eat sparingly until the warm weather begins, when they become quite insatiable: one of them will then swallow twenty-seven large worms one after the other. When they were first put into the pond, and had no food given to them, they devoured one another. They generally lie quietly at the bottom of the pond, except when any of the family go and look into it, when they invariably rise to the surface, sometimes for food, and at others merely to play with the hand, or take the fingers into their mouths. About the month of August they become very restless, and take every opportunity of the pond overflowing from rain to get out; when sought for in the garden, on these occasions, they are invariably found travelling *eastwards* (the direction of the sea, which is about four miles from Craigo). Towards the end of August, or beginning of September, they retire to their winter retreat under the stones. Whether they breed in this pond or not is uncertain; but on clearing it out last summer a few very small Eels were discovered, and how else they could have found their way there is not easy to conjecture, as there is a fine rose on the mouth of the pipe by which the water enters. From their rapacity, shown in devouring their companions,—some Goldfish,—it is possible they may eat the greater part of their own small fry.—*Edin. New. Phil. Journ. for April* 1841, *p.* 439.

" Most of the writers on the habits of the Eel have described them as making two migrations in each year: one in the autumn *to* the sea; the other in spring, or at the beginning of summer, *from* the sea. The autumn migration is performed by adult Eels, and is believed to be for the purpose of depositing their spawn; it is also said that these parent fish never return up the rivers. The spring migration is commonly supposed to be confined to very small Eels, not more than three inches in length, and in reference to the fry alone, it is too well known, and too often recorded, to be matter of doubt. The passage of countless hundreds of young Eels has been seen and described as occurring in the Thames,* the Severn, the Parrett, the Dee, and the Ban.

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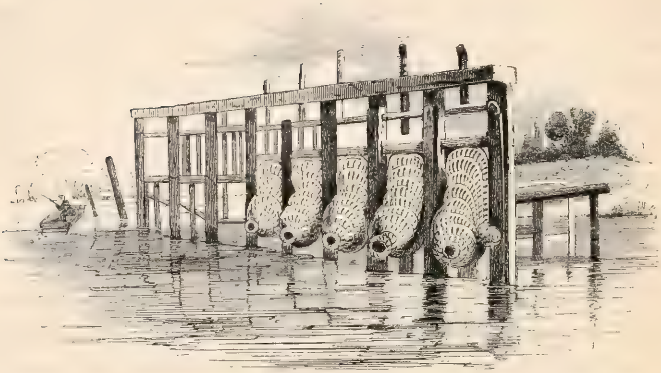
* See an excellent account by Dr. William Roots, of Kingston, published in the second series of Gleanings in Natural History, by Edward Jesse, Esq. p. 50.

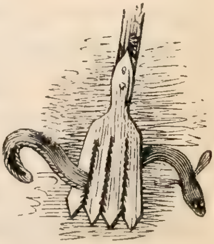
I am, however, of opinion, that the passage of adult Eels to the sea, or rather to the brackish water of the estuary, is an exercise of choice, and not a matter of necessity; and that the parent Eels return up the river as well as the fry."

"All authors agree that Eels are extremely averse to cold. There are no Eels in the arctic regions,—none in the rivers of Siberia, the Wolga, nor even in some of the tributaries of the Danube; yet the rivers of the southern parts of Europe produce four species. There is no doubt that fishes in general, and Eels in particular, are able to appreciate even minute alterations in the temperature of the water they inhabit. The mixed water they seek to remain in during the colder months of the year is of a higher temperature than the pure fresh water of the river, or that of the sea. It is a well-known law in chemistry, that when two fluids of different densities come in contact, the temperature of the mixture is elevated for a time in proportion to the difference in the density of the two fluids, from the mutual penetration and condensation. Such a mixture is constantly taking place at the mouths of rivers that run into the sea, and the mixed water maintains a temperature two degrees warmer than that of the river or the sea. This elevation in the temperature of the water of estuaries and the mouths of rivers is, I have no doubt, one reason why they in general abound in young fish."

In a tideway river the descent of the Eels towards the brackish water takes place during the autumn, and various devices are employed in different streams to intercept them in their progress. The figure given on the next page represents the form of an apparatus used in various parts of the Thames, called an Eelbuck, consisting of a framework of wood supporting various wicker-baskets of a particular form. The large open end of each basket is opposed to the stream, and by the peculiar structure of the inside, any fish once within the body of the basket cannot escape.



During the cold months of the year Eels remain imbedded in mud; and large quantities are frequently taken by Eel-spears in the soft soils of harbours and banks of rivers, from which the tide recedes, and leaves the surface exposed for several hours every day. The Eels bury themselves twelve or sixteen inches deep, near the edge of the navigable channel, and generally near some of the many land-drains, the water of which continues to run in its course over the mud into the channel during the whole time the tide is out. In Somersetshire the people know how to find the holes in the banks of rivers in which Eels are laid up, by the hoar-frost not lying over them as it does elsewhere, and dig them out in heaps. The practice of searching for Eels in mud in cold weather is not confined to this country; Dr. Mitchell, in his paper on the Fishes of New York, published in the Transactions of the Literary and Philosophical Society of that city, says, "In the winter Eels lie concealed in the mud, and are taken in great numbers by spears." Thus imbedded in



mud, in a state of torpidity, the Eel indicates a low degree of respiration. Dr. Marshall Hall has shown that the quantity of respiration is inversely as the degree of irritability. With a high degree of irritability and a low respiration, co-exist—1st. The power of sustaining the privation of air and of food; 2nd. A low animal temperature; 3rd. Little activity; 4th. Great tenacity of life. All these peculiarities Eels are well known to possess. The high degree of irritability of the muscular fibre explains the restless motions of Eels during thunder-storms, and helps to account for the enormous captures made in some rivers by the use of gratings, boxes, and eel-pots or baskets, which imprison all that enter. The power of enduring the effects of a low temperature is shown by the fact, that Eels exposed on the ground till frozen, then buried in snow, and at the end of four days put into water, and so thawed slowly, discovered gradually signs of life, and soon perfectly recovered.

The mode by which young Eels are produced appears to have long been a subject of inquiry, and the notions of the ancients as well as of some of the moderns were numerous and fanciful. Aristotle believed that they sprang from the mud; Pliny, from fragments which were separated from their bodies by rubbing against rocks; others supposed that they proceeded from the carcasses of animals; Helmont believed that they came from May-dew, and might be obtained by the following process:—"Cut up two turfs covered with May-dew, and lay one upon the other, the grassy sides inwards, and thus expose them to the heat of the sun; in a few hours there will spring from them an infinite quantity of Eels." Horse-hair from the tail of a stallion, when deposited in water, was formerly believed to be a never-failing source of a supply of young Eels. It was long considered certain that they were viviparous: this belief had its origin probably in the numerous worms that are frequently to be found in various parts of the bodies of Eels, sometimes in the serous cavities, at others in the intestinal canal. Rudolphi has enumerated eight different species of entozoa common to fresh-water Eels. The enormous number of young known to be produced by Eels is a good negative proof that they are oviparous; viviparous fishes producing, on the contrary, but few young at a time, and these too of considerable size when first excluded. Having devoted time and attention to the close examination of numbers of Eels for many months in succession, the further details of which will be found in Mr. Jesse's second series of Gleanings in Natural History, I need only here repeat my belief that Eels are oviparous, producing their young like other true bony fishes.

"The sexual organ consists of two long narrow sacs extending one on each side of the air-bladder throughout the whole length of the abdominal cavity, and continued for two inches posterior to the vent. The membranes forming this tubular sac, secreting on the inner surface the milt of the male, and affording attachment for the ova in the female, are puckered or gathered along the line of junction to the peritoneal covering of the spine, and the free or loose floating edge is therefore thrown into creases or plaits like a frill. It is probably from this folded or convoluted appearance the sexual organs of the Eel have frequently been called fringes. By the kindness of my friends Mr. Clift and Mr. Owen, of the Royal College of Surgeons, I have had the pleasure of seeing some drawings belonging to the collection of John Hunter, in which these peculiarities of the sexual organs in the Eel are beautifully exhibited in various magnified representations." These representations are now published.

Dr. Mitchell of New York, whose paper on Fishes has been already referred to, says, "the roes or ovaria of Eels may be seen by those who will look for them in the proper season, like those of other fishes."

Eels that have lain in brackish water all the winter under the constant influence of the higher temperature of that locality, probably deposit their spawn earlier in the spring than those which have passed the winter in places from which there existed for them no possible egress. In the Mole, the Wey, the Longford river, and in some large ponds, the Eels in the spring of 1833 did not deposit their spawn till near the end of April; but in two Eels from Sheerness received and examined on the 18th of May, the internal appearances induced me to believe that the roes had been passed some time. How long the ova remain deposited before the young Eel is produced, is, I believe, unknown. The duration of this interval is very variable in different fishes. The roe of the Herring, deposited at the end of October or the beginning of November, is said to become living fry within three weeks: the ova of Eels, the produce of which is very small, do not probably require a longer period. Both the parent Eels and the fry occupying the brackish water appear to have the power of going either to the salt water or to the fresh without inconvenience, from the previous preparation which the respiratory organs have undergone, and many of both are found in pure sea water: the great bulk of the young, however, certainly ascend the stream of the river, and their annual appearance in certain places is looked for with some interest. The passage of young Eels up the Thames at Kingston in the year 1832 commenced on the 30th of April, and lasted till the 4th of May; but I believe I am correct in stating that few young Eels were observed to pass up the Thames either in the year 1834 or 1835. Some notion may be formed of the quantity of young Eels, each about three inches long, that pass up the Thames in the spring, and in other rivers at the beginning of summer, from the circumstance that it was calculated by two observers of the progress of the young Eels at Kingston in 1832, that from sixteen to eighteen hundred passed a given point in the space of one minute of time. This passage of young Eels is called Eel-*fare* on the banks of the Thames,—the Saxon word signifying to go, to pass, to travel;* and I have very little doubt that the term *Elver*, in common use on the banks of the Severn for a young Eel, is a modification or corruption of Eel-fare.

"When the Elvers appear in the Severn, they are taken in great quantities with sieves of hair cloth, or even with a common basket, and, after being scoured and boiled, are offered for sale. They are either fried in cakes or stewed, and are accounted very delicious."

There is no doubt that Eels occasionally quit the water, and when grass meadows are wet from dew, or other causes, travel during the night over the moist surface in search of frogs and other suitable food, or to change their situation. Some ponds continually produce Eels, though the owners of these ponds are most desirous of keeping the water free from Eels, from a knowledge of their destructive habits towards the spawn and fry of other fishes. Other ponds into which Eels have been constantly introduced are obnoxious to them from some quality in the water; and they are known to leave such places during the night, and have been found on their passage to other retreats. Dr. Hastings, in his Illustrations of the Natural History of Worcestershire, says at page 134: "I will here mention a curious confirmation of the opinion in favour of the overland migration of Eels. A relative of the late Mr. Perrott was out in his park with his keeper near a large piece of water, on a very beautiful evening, when the keeper drew his attention to a fine Eel quietly ascending the bank of the pool, and with an undulating motion making its way through the long grass: on further observation he perceived a considerable number of Eels quietly proceeding to a range of stews, nearly the distance of a quarter of a mile from the large piece of water from whence they started. The stews were supplied by a rapid brook, and in all probability the instinct of the fish led them in that direction as a means of finding their way to some large river from whence their ultimate destination, the sea, might be obtained. This circumstance took place at Sandford Park, near Enstone."

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* A pedestrian on the road is called "a way-faring man;" and hence, also, the price for travelling by a conveyance is called "the fare." We have also "thoroughfare," &c.

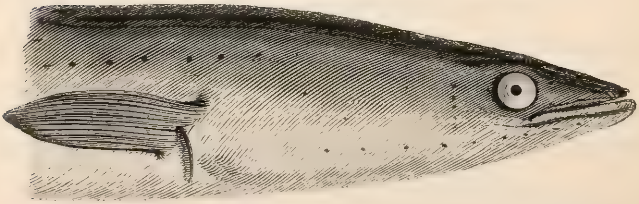
That Eels breed also in the fresh water of inland rivers and lakes from which they are unable to visit the sea, is, I believe, certain. A constant supply for the table is obtained throughout the winter in these localities, as well as at other seasons, by gamekeepers and fishermen, who have charge of waters thus situated; and no doubt exists in their minds that these Eels are bred in the places from which they are obtained, and of which the great variation that occurs in the size is an additional proof.

The Eel is a voracious feeder during certain months of the year. In winter the stomachs of those which I examined were empty; by the middle of March I found the stomachs of others distended with the larvæ of various insects, and the bones of small fishes. They are known to consume a large quantity of spawn, and will attack large Carp, seizing them by the fins, though without the power of doing them further injury. Occasionally they eat vegetable substances, and have been seen swimming about the surface of water, cropping the leaves of small aquatic plants. By means of a long and capacious air-bladder, Eels rise to various elevations in the water with great ease, and sometimes swim very high even in deep water. When Whitebait-fishing in the Thames, I once caught an Eel in the net in twenty-six feet depth of water, though the Whitebait-net does not dip more than about three feet below the surface.

Eels appear to be slow of growth, not attaining greater length than twelve inches during the first year, and do not mature roe till the second or third year. The sharp-nosed species, however, acquires a large size. I saw at Cambridge the preserved skins of two which weighed together fifty pounds; the heaviest twenty-seven pounds, the second twenty-three pounds. They were taken on draining a fen-dyke at Wisbeach. No other fish of any sort was found in that dyke.

Ely is said to have been so named from rents being formerly paid in Eels: the lords of manors in the isle were annually entitled to more than 100,000 Eels. A stich or stick of Eels was twenty-five; and the practice of stringing Eels on tough slender willow-twigs, put in at the gill-aperture and out at the mouth, still prevails in Dorsetshire among those who carry Eels about for sale from house to house one, two, or three pounds' weight being thus strung on a stick, to suit different customers. Elmore on the Severn obtained its name from the immense number of Eels which are taken there.

In a Sharp-nosed Eel of twenty-two inches in length, three distances taken from the point of the lower jaw are to



the whole length of the Eel as follows :—to the upper part of the base of the pectoral fin, as two to seventeen ; to the commencement of the dorsal fin, as two to seven ; and to the commencement of the anal fin, as nine to twenty-two. In a Sharp-nosed Eel of twenty inches in length, the pectoral fin will be almost one inch, and the vent more than an inch, nearer the head than the same parts in a Broad-nosed Eel of the same length.

The head is compressed, the top convex, depressed as it slopes forward : the eye small, placed immediately over the angles of the mouth ; irides reddish yellow : the jaws very narrow, slightly rounded at the end ; the lower jaw the longest : nostrils with two openings on each side, one tubular, the other a simple orifice ; both jaws furnished with a narrow band of small teeth ; gape small ; various mucous pores about the mouth and other parts of the head ; gill-opening a small aperture immediately before and rather below the origin of the pectoral fin ; the scales on the body rather small : dorsal fin extending over more than two-thirds of the whole length of the fish ; anal fin occupying more than half of the whole length ; both united at the end, forming a tail ; the number of rays in the fins not easily ascertained, from the thickness of the skin ; the lateral line exhibits a long series of mucous orifices ; vertebræ 113. The vent includes four distinct openings, the most anterior of which leads upwards to the intestine, the posterior to the urinary bladder in a direction backwards, and one elongated lateral opening on each side communicating with the cavity of the abdomen, as in other bony fishes.

The cranium on the right hand of the three, figured at page 401, is that of the Sharp-nosed Eel.

The prevailing colour of all the upper surface is a dark olivaceous green ; the sides lighter ; the belly white. When the fish are obtained from pure streams, the colours are clear and bright, and it is called a Silver Eel; when taken from water over a muddy bottom, the colours are brown and dusky.

Dr. Marshall Hall, in 1831, while pursuing some physiological investigations on the circulation of the blood in various reptiles and fishes, observed a pulsating sac near the tail of the Eel. The form, action, and connexions of this sac are best seen under the microscope. A young Eel of six or seven inches in length, if rolled up in a strip of linen cloth, leaving out a small portion only of the tail, will remain quiet when placed on a long slip of glass, or may be tied to it with thread. The pulsation observed in this sac is entirely independent of the action or influence of the heart, and the number of beats more than double in the same period of time; they also continue after the heart has been removed. Some Continental physiologists have ascertained that these pulsating sacs, which are found in the frog, the toad, the salamander, and the green lizard,* contain lymph, and direct its motion, and they have accordingly called them lymphatic hearts. They are only observed in connexion with veins. "Such is," says Dr. Müller, "the pulsating organ discovered by Dr. Marshall Hall at the end of the vena caudalis of the Eel, where that organ receives the venous branches of the extremity of the tail, and conducts its blood into the vena caudalis. But organs of pulsation in the lymphatic system have hitherto been altogether unknown; it is not probable that they should exist only in amphibia, and important discoveries of a similar nature in the higher animals, such as birds and mammalia, may be expected; my researches, as regards these, have however been hitherto unsuccessful." In another part of his paper, Dr. Müller observes, "I have never discovered a trace of motion in the cysterna chyli and ductus thoracicus of mammalia."

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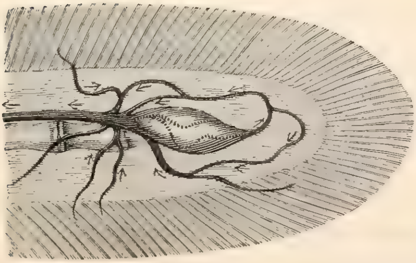
* See a paper in the Philosophical Transactions for 1833, by Dr. John Müller, Professor of Physiology in the University of Bonn.

In a conversation with Mr. Owen on this subject, he suggested, that as the valves of the lymphatic vessels are very few and imperfect in reptiles and fishes, especially in the latter, these pulsating sacs would seem to be superadded as a compensating power in the absence of that mechanism which impresses a definite direction and an unintermitting flow upon the currents of the lymph in the higher vertebrata, especially mammalia.

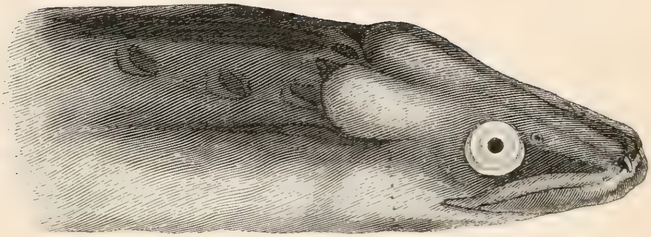
I am indebted to the kindness of Dr. Marshall Hall for permission to copy the excellent illustration of this structure in the tail of the Eel, from his very interesting critical and experimental essay on the circulation of the blood.

In the vignette the arrow-heads indicate the direction of the currents.



APODAL
MALACOPTERYGII.

MURÆNIDÆ.



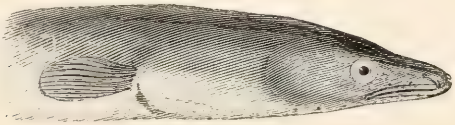
THE BROAD-NOSED EEL.

Anguilla latirostris,	*Broad-nosed Eel,*	YARRELL, Proceed. Zool. Soc. 1831. pp. 133 and 159. Zool. Journ. vol. iv. p. 469.
,, ,,	,, ,,	JENYNS, Man. Brit. Vert. p. 476, sp. 164.
,, ,,	*A. pimperneaux,*	CUVIER, Règne An. t. ii. p. 349.
,, ,,	*Glut Eel,*	BOWDICH, Brit. Fr. Wat. Fish, No. 22.

THE BROAD-NOSED EEL is almost as common a species as the Sharp-nosed Eel, but is immediately distinguished from it by the much greater comparative breadth of the head; the representation at the top of the page is therefore confined to that part of the fish which exhibits the best distinctions; and the vignette to the Snig Eel, page 401, represents in the left-hand figure of the three heads the cranium of the Broad-nosed Eel, to show this character as it exists in the bone. This Eel is the Grig or Glut Eel of Pennant, who says, "They have a larger head, blunter nose, and thicker skin than the common sort." It is, probably, also the Frog-mouthed Eel of the Severn, referred to by Dr. Hastings, in his Natural History of Worcestershire, page 135, and so called by the fishermen from the extraordinary width of the mouth.

In its habits the Broad-nosed Eel has not been distinguished by any peculiarity that I am aware of from the other common Eel; but it does not appear to attain so large a size, the largest I have seen not exceeding five pounds in weight. It exists in many of the waters which produce the Sharp-nosed Eel, is much thicker in the body in proportion to its length, and fishermen can distinguish this species readily when fishing in the dark by its more soft and unctuous feel in the hand.

The term Grig is, however, in and about London, applied to a particular Eel of small size, of which the figure here introduced represents the head. This Eel is the *Anguille plat-bec* of Cuvier, *Règne Animal*, tom. ii. p. 349, who considers it a distinct species. It is the Grig Eel also of Mrs. Bowdich's British Fresh Water Fishes, No. 28, in which work the three Eels already spoken of here are well figured; and the species were considered by Cuvier as identical with those of the *Règne Animal.*



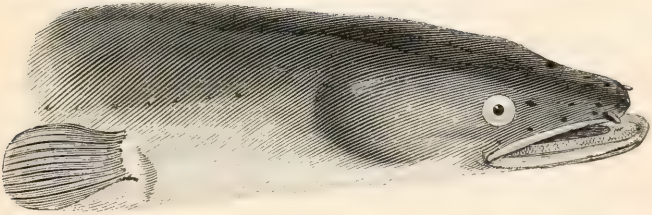
The name Grig is also applied by Thames fishermen to any small-sized Eel of any species when not longer than eight or nine inches, and of which eight or ten are required to make up a pound weight.

In a Broad-nosed Eel of twenty-two inches in length, three distances taken from the point of the lower jaw are to the whole length as follows:—to the upper part of the base of the pectoral fin, as two to thirteen ; to the commencement of the dorsal fin, as one to three ; and to the commencement of the anal fin, as ten to twenty-two.

The Broad-nosed Eel has the head rounded at the back part, and flattened from the eyes forward ; both jaws broad and blunt ; the lower jaw the widest, and longer than the upper : nostrils double, one tubular, the other a plain orifice ; the gape large ; lips fleshy : teeth more numerous than in either of the other British fresh-water species, larger, stronger, and forming a much broader band in each jaw : the eyes large, placed before the line of the gape ; irides golden yellow : the gill-openings, pectoral fins, the commencement of the dorsal fin, and the vent, placed farther back than in the Sharp-nosed Eel ; dorsal and anal fins also much deeper and thicker ; the tail broad and rounded ; the body of the fish thicker for the same length than in other Eels : the number of vertebræ 115.

The colour of the upper surface of the body is a dark-greenish brown, subject to some variation, depending on locality, soil, and the quality of the water.

APODAL MALACOPTERYGII. *MURÆNIDÆ.*



THE SNIG.

Anguilla mediorostris, Snig Eel, Yarrell. Jesse, Glean. Nat. Hist. 2nd Series, pp. 75 and 76.
,, ,, ,, ,, Jenyns, Man. Brit. Vert. p. 477, sp. 165.

I am indebted to the kindness of Mr. Jesse, and his friend, Francis Mills, Esq. for the first specimens of this Eel I have seen; and from some differences in its external characters, in its habits, and also in the comparative size of the head, as well as some peculiarity in the five cervical vertebræ that are nearest the head, I believe it to be a different species from either of those previously described in this work.

The specimens I have had were from the Avon in Hampshire, where this Eel, rather remarkable for its yellow colour, is called the Snig, and is considered distinct from the other well-known and more common Eels.

Dr. Hastings, in the Appendix to his Illustrations of the Natural History of Worcestershire, page 135, says, that besides an Eel called the Frog-mouthed Eel by the fishermen, from the extraordinary width of the mouth,—identical, probably, with the Broad-nosed Eel of this work,—"there are two distinct kinds of Eels in the Worcestershire Avon, the Silver and Yellow Eel," which last may be similar to the Snig of the Avon of Hampshire.

The term Snig, it should however be stated, is in some counties a general name for any sort of Eel; and a particular mode of fishing for Eels, which is described in most of the works on Angling, is called Sniggling.

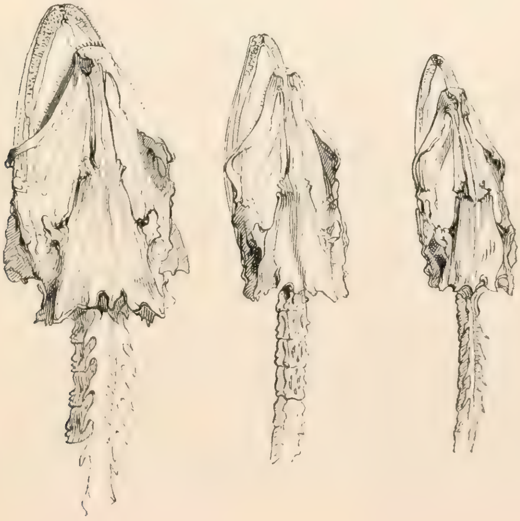
The Hampshire Snig differs from our other Eels in its habit of roving and feeding during the day, which other Eels do not. It is considered excellent as an article of food, and of a superior flavour to other Eels: it does not however attain a large size, seldom exceeding half a pound in weight.

The fishermen make a certain difference in the mode of placing their eel-pots when they are desirous of catching Snigs; finding by long experience that the Snigs get into those pots the mouths of which are set in the opposite direction, in reference to the stream, to others in which the common Eels are taken.

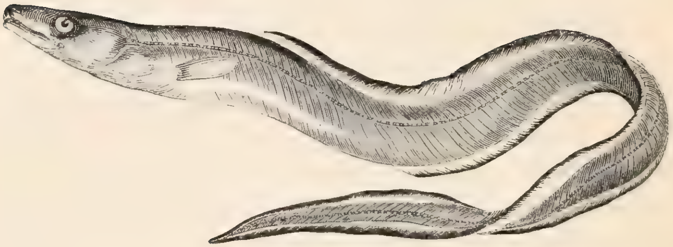
In the comparative breadth of the nose, the Snig is intermediate in reference to the Sharp and Broad-nosed Eels, but rather more resembles that with the sharp nose; it has a slight but elongated depression extending from the anterior edge of the upper jaw to the upper and back part of the head; the tubular openings of the nostrils are longer, and the mucous pores about the lips larger and more conspicuous; both jaws rounded at their extremities, the lower one the longest; teeth longer and stronger than in the common sharp-nosed species; gape large; the angle and the posterior edge of the eye on the same vertical line; the pectoral fins, the commencement of the dorsal fin, and the vent, are each placed nearer the head than in either of our fresh-water Eels.

The general colour olive green above, passing by a lighter green to yellowish white below.

Desirous of obtaining internal characters of distinction among our fresh-water Eels, I prepared skeletons of each species, selecting three examples that measured exactly the same length, in order to afford a more just comparison. The vignette at the bottom of the page represents correctly the relative size and power of bone in each species. The cranium on the left is that of the Broad-nosed Eel; that in the middle is from the Snig; the head on the right hand is from the Sharp-nosed Eel. It is obvious that each is able to overcome a larger and more powerful victim as food than the other. It will also be seen, that independent of some difference in the length and form of some of the bones, as well as in the size of the head in the middle, belonging to the Snig, as compared with that on either side, there is a characteristic distinction in the form of the bones of the vertebral column. The first five cervical vertebræ are smooth and round, entirely destitute of superior or lateral spinous processes, both of which are possessed by the other two, of a size corresponding to the character of the vertebral bone itself to which it belongs. With this exception, the skeleton of the Snig most resembles that of the Sharp-nosed Eel; but is somewhat stronger, and particularly so in the processes of the other vertebræ generally.



APODAL
MALACOPTERYGII. *MURÆNIDÆ.*



THE CONGER.

Conger	*vulgaris,*	*Le Congre,*	CUVIER, Règne An. t. ii. p. 350.
		Conger,	WILLUGHBY, p. 111, G. 6.
Muræna	*Conger,*	,,	LINNÆUS. BLOCH, pt. v. pl. 155.
,,	,,	*Conger Eel,*	PENN. Brit. Zool. vol. iii. p. 196.
,,	,,	,,	DON. Brit. Fish. pl. 119.
,,	,,	,,	FLEM. Brit. An. p. 200, sp. 110.
Anguilla	,,	,,	JENYNS, Brit. Vert. p. 478.

CONGER. *Generic Characters.*—The dorsal fin commences much nearer the head than in the fresh-water Eels; the upper jaw the longest; in other respects resembling the genus *Anguilla.*

THE CONGER EEL is a marine species well known on all the rocky parts of the coast of the British Islands, but nowhere more abundant than on the coast of Cornwall.

Mr. Low says, "It is found very frequently round the Orkney Islands: some are caught at the fishermen's lines; but the otter is by far the most successful in killing Congers. He brings them ashore, and eats but a very small part, leaving the rest for the next comer; and where his haunts are known, the country people are very careful every morning to search for the remains of the night, and are seldom disappointed, but find Cod, Ling sometimes, but especially Congers, which are oftener seen amongst the deep hollows of the rocks than farther to sea."

Dr. Neill and Dr. Parnell say this species is taken in the Forth, and finds a ready sale in Edinburgh market.

The Conger is frequently caught at various rocky parts of our eastern coast, and I have known specimens of large size taken in winter about the mouth of the Thames. Congers are caught by bulters, or long-lines, and hand-lines—modes of fishing already described, and the most esteemed bait is the sandlaunce. " So well assured," says Colonel Montagu, " are the French fishermen of the advantage derived from the use of this little fish, that the fishing-boats in times of peace run over from the coast about Dieppe to Slapton Bay, on the south coast of Devon, on purpose to purchase launce; and for that purpose alone do some of our fishermen keep fine nets for the purpose of supplying bait to these foreigners, for which they obtain about twenty-pence the bushel. Some principal Conger banks lie off the French coast, from which a prodigious quantity are taken to feed the poorer classes on maigre days.

The principal fishery for Congers in this country is on the Cornish coast; where, according to Mr. Couch, it is not uncommon for a boat with three men to bring on shore from five hundred weight to two tons, the fishing being performed during the night; for this fish will not readily take a bait by day, and even on moonlight nights it is more shy than when in the dark, except in deep water. The most usual bait with the Cornish fishermen is a Pilchard. The Congers that keep among rocks hide themselves in crevices, where they are not unfrequently left by the retiring tide; but in situations free from rocks, Congers hide themselves by burrowing in the ground.

The flesh is not in much estimation, but meets a ready sale at a low price among the lower classes. Formerly a very considerable quantity was prepared by drying in a particular manner, and exported to Spain: Bayonne also received a part. When thus dried, the flesh was ground or grated to powder, and in this state was used to thicken soup.

Congers spawn in December or January; and the distinction of the sexes is obvious on the examination of the roe during the cold months. Small ones, about the size of a man's finger, are found among rocks, close to land, during the summer. The small Eels which ascend the Severn in such numbers in the spring, and were considered by Willughby and Pennant as the young of the Conger, are in reality the young of fresh-water Eels.

The adult fish is most voracious, not sparing even those of its own species. From the stomach of a specimen weighing twenty-five pounds, I took three common Dabs, and a young Conger of three feet in length. The power of the jaws in this fish is very great: in the stomach of small specimens examined on the coast, I have found the strong testaceous coverings of our shell-fish comminuted to fragments. They are often tempted by the crustacea entrapped in the lobster-pots to enter those decoys in order to feed on them, and are thus frequently captured.

Congers acquire a very large size. Specimens weighing eighty-six pounds, one hundred and four pounds, and even one hundred and thirty-pounds, have been recorded, some of them measuring more than ten feet long, and eighteen inches in circumference. They possess great strength, and often prove very formidable antagonists if assailed among rocks, or when drawn into a boat on a line.

Three measurements taken from the point of the nose, as in the fresh-water species, give the following proportions in reference to the whole length:—the distance to the origin of the pectoral fin is as two to thirteen; to the commencement of the dorsal fin, as one to five; and to the vent, as two to five.

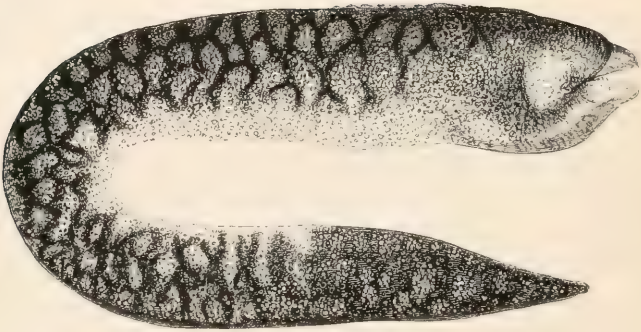
The head is long and depressed: the upper jaw the longest; both jaws furnished with strong teeth, forming a broad band in each: the lips fleshy: the nostrils double; the most anterior near the edge of the lip, and tubular; the other a simple orifice: numerous mucous pores about the parts of the mouth and head: the mouth deeply divided, making the gape long; the angle forming a tangent with the posterior edge of the pupil: the eyes large; body nearly cylindrical; dorsal fin commencing immediately behind the pectorals, extending along four-fifths of the whole length of the body; anal fin commencing immediately behind the vent, and extending along three-fifths of the whole, and joining the dorsal fin, forms a pointed tail.

The colour of the upper surface of the body is a uniform pale brown, becoming lighter on the lower part of the sides, and passing into dull white underneath; the dorsal and anal fins whitish, edged with black; lateral line almost white; but the colour varies, depending on the situation from which the Conger has been taken.

The notion entertained by some, that river Eels on going to the sea remain there and become Congers, scarcely requires a serious remark. No one who looks for specific distinctions can fail to observe them when comparing either of our fresh-water Eels with the Conger. These differences, which extend to colour, form of body, and situation of fins, receive further confirmation on examining their internal structure: independent of comparative difference of relative position in some of the most important of the viscera, the greatest number of vertebræ found in our fresh-water Eels is 116, those of the Conger amount to 156.

In the beginning of February of the present year, 1841, large quantities of the Sharp-nosed Eel were killed by frost in the river Logan at Belfast, in the Bay at Dundalk, and also in the Lee below Cork: the last were Conger Eels. A similar occurrence took place in January 1814.—See Annals of Nat. Hist. vol. vii. pp. 75 and 236.

APODAL MALACOPTERYGII. *MURÆNIDÆ.*



THE MURÆNA.

Muræna Helena, Linnæus. Bloch, pt. v. pl. 152.
,, ,, *La Murène*, Cuvier, Règne An. t. ii. p. 352.
,, ,, *The Muræne*, Couch, MS.
,, ,, ,, Jenyns, Brit. Vert. p. 479.

Muræna. *Generic Characters.*—Body elongated; no pectoral fins; branchial opening a minute orifice on each side; a single row of teeth in each jaw; dorsal and anal fin very low, united.

Mr. Couch is the only British naturalist I have heard of who has obtained an example of this beautifully marked species on the English coast. The following is Mr. Couch's account, copied from his MS.:

A specimen, the first on record as a British fish, was caught by a fisherman of Polperro, October 8th, 1834.

Its length was four feet four inches; body very flaccid, rounded anteriorly, compressed and tapering towards the tail: the whole body seemed plump. Before the eyes it is slender and sharp; jaws equal; gape moderately large; teeth long, incurved, sharp, separate, in one row, a row on the palate; tongue adherent, scarcely perceptible; a nasal barb on each side of the end of the snout, another a short distance above each eye, and a probe passed down the latter found its way out at the former; large mucous orifices encircle both jaws at equal distances, four on each row. Eye rather small, one inch and one quarter from the snout; irides light bluish grey, having a lively look; cheeks tumid; an extensive depression at the side of the thorax, in which is the simple orifice of the gills; the external appearance of the branchial aperture very much resembles that belonging to the Lamprey: from the snout to the branchial opening, six inches; from the part above the eye the head is much elevated; the skin wrinkled; thorax remarkably protuberant; the distance from the top of the head to the thorax five inches and three-quarters. The vent is exactly half-way between the two ends of the body, from whence proceeds a line to the end of the tail parallel to the anal fin, and half an inch from its base: this line must be the lateral line, since there is no appearance of any other. The dorsal fin begins five inches and a half from the snout, and proceeds round the extremity of the body to join the anal, which begins at the vent; but these fins are thick and fleshy, and not readily distinguished from the margin of the body.

The ground colour of the anterior part of the body is a fine lively yellow, the hinder part a fine purple; but the whole, including the fins, is divided into segments, forming irregularly shaped spots, which yet have a tendency to regular distribution; towards the tail the yellow spots more resemble irregular rings, with larger spaces between them; the whole is interspersed with innumerable spots of whitish and deep yellow, golden, brown, and purple, forming a most beautiful arrangement: under the thorax and to the gill-opening are a few lines marked in the skin as if to facilitate motion, though the skin is exceedingly smooth and soft;

it is strong also, and the colours were remarkably slow to fade, contrary to what is observed in most fishes. This specimen was taken with a line, and manifested great strength after it was taken on board the boat.

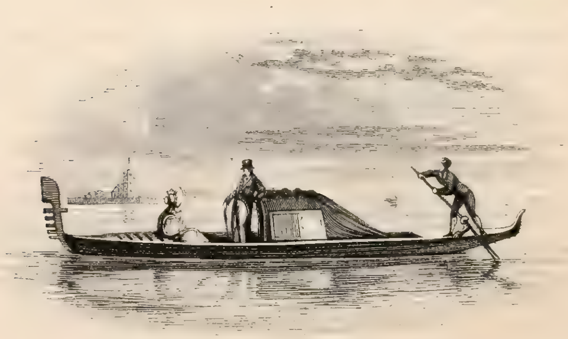
Of this singular and beautifully marked fish Mr. Couch very kindly sent me for my use a coloured drawing made from the fresh specimen, from which the figure on the preceding page, carefully reduced in size, was drawn and engraved.

This Muræna is considered very common in almost every part of the Mediterranean. It was a great favourite with the ancient Romans, who preserved large quantities of them in their numerous vivaria, where they were fed with great care. On the celebration of one of his triumphs, Cæsar distributed six thousand specimens of this Muræna among his friends.

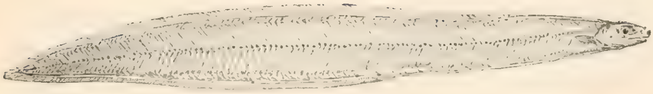
The flesh is said to be delicately white, and very agreeable eating. In the Mediterranean it is fished for with lines. It is very voracious, and its bite is very severe, which, from the nature of the teeth, and the large size of the muscles about the head, might be expected.

This fish is said to live with equal facility in fresh or salt water, though generally found at sea.

The vignette represents a Venetian pleasure-boat.



APODAL
MALACOPTERYGII. *MURÆNIDÆ.*



THE ANGLESEY MORRIS.

Leptocephalus Morrisii, Anglesey Morris, Penn. Brit. Zool. vol. iii. p. 212, pl. 28.
,, ,, ,, ,, Montagu, Wern. Mem. vol. ii. p. 436, pl. 22, f. 1.
,, ,, ,, ,, Flem. Brit. An. p. 200, sp. 111.
,, ,, ,, ,, Jenyns, Brit. Vert. p. 480.
,, ,, *Le Leptocephale,* Cuvier, Règne An. t. ii. p. 358.

Leptocephalus. *Generic Characters.*—Head small and short; teeth numerous; pectoral fins and gill-opening very small; body compressed and very thin, tape-like; dorsal and anal fins small, united at the tail, forming a point.

This species was discovered in the sea near Holyhead by Mr. William Morris, who sent the specimen to Pennant, by whom it was named after his friend. Pennant subsequently sent the same specimen to Gronovius, who described it under the generic name of *Leptocephalus*, in reference to the small size of the head.

Any doubts which might formerly have been raised as to the real existence of such a species, to which Colonel Montagu has alluded, must have ceased to exist, as this fish has now been taken and recognised in various localities. Pennant, in his first description, perhaps from the state of his specimen, was not aware of all the characters this delicate fish possesses; but Colonel Montagu has well described and given a figure of it in the Wernerian Memoirs, as quoted. More than twenty specimens have within a few years been taken at different parts of the coast of England, Wales, and Ireland. By the kindness of Mr. Couch, I possess three examples that were taken in Cornwall; and from Mr. William Thompson, of Belfast, we learn that five or six specimens have been obtained by him and his collecting friends.

There is also an interesting account of this fish, with a good figure, in the sixth volume of Mr. Loudon's Magazine of Natural History, page 330, by H. V. Deere, Esq. who states that his specimen, to all appearance dead, was brought to him by a Devonshire fisherman, who had carried it in his pocket, wrapped in brown paper, for three hours. After this gentleman had held the fish in his hand for about a minute, examining it, symptoms of life appeared, and then the little animal was placed in a tumbler of salt and water, where it survived its incarceration in brown paper for several hours. Its appearance is described as most pleasing, from its semitransparent and silvery hue, its prominent eye, and graceful motions. It is usually found among seaweed.

I carefully dissected off the whole of one side from one of the three specimens sent me by Mr. Couch, laying bare the vertebral column and the intestinal canal. The bones forming the vertebræ have no spinous processes whatever, either superior or inferior; the angles of the ascending and descending oblique indented striæ, visible on the external surface of the skin, mark the points of union of the different vertebræ; the oblique muscles between the striæ are attached to the bodies of the bones forming the column; the margin all round each vertebral bone is opaque, but the centre or body of each is transparent.

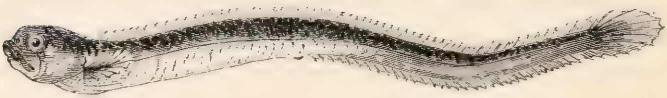
The intestine is a single straight canal of small calibre, reaching from the head to the vent; after passing from the posterior part of the head, it descends to the abdominal line, which it traverses without convolution to the vent. This canal may be distinctly seen in the perfect fish when placed flat on a slip of glass, and looked at against a good light, particularly the descending portion from the head to the level of the abdominal line.

The head is small, short, and rather blunt: the eyes large; irides silvery, the pupil dark: the lower jaw slender; teeth in both jaws, numerous and minute; gill-openings and pectoral fins very small; the body behind the head becomes deeper, very much compressed, as thin as tape, and when rendered opaque by the effect of a mixture of spirit of wine and water, which is the best mode of preserving them, this fish very much resembles a piece of a tape worm.

The dorsal fin commences rather before the middle of the whole length of the fish; the anal fin rather behind it; and both extend to the tail, where they are united, and end in a point. These fin-like appendages have the appearance of an extension of the skin, and are so delicate that it is not always easy to decide where they do begin, or may be called fin; the dorsal and abdominal margins, as well as the lateral line, exhibit a series of small black specks: the obliquely striated appearance of the sides has been already referred to. The general colour is most like that of opal.

I have had opportunities of examining specimens from the Mediterranean which were identical with those from Cornwall, as well as those described and figured in the English works already referred to. M. Risso includes but one species in his fishes of Southern Europe and the Environs of Nice, which he has named *Leptocephalus Spallanzani*, tom. iii. p. 205; but the description so exactly accords with English specimens, that I have no doubt it is the fish I have seen, and the same as that on our own shores.

APODAL
MALACOPTERYGII. *MURÆNIDÆ.*



THE BEARDLESS OPHIDIUM.

Ophidium imberbe, Linnæus.
,, ,, *Beardless Ophidium*, Penn. Brit. Zool. vol. iii. p. 208, pl. 29.
,, ,, ,, ,, Montagu, Wern. Mem. vol. i. p. 95, pl. 4, f. 2.
,, ,, ,, ,, Flem. Brit. An. p. 201, sp. 112.
,, ,, ,, ,, Jenyns, Brit. Vert. p. 481.

Ophidium. *Generic Characters.*—Head smooth; body elongated, compressed; teeth in both jaws, the palate, and pharynx; gill-aperture rather large; dorsal, anal, and caudal fin united.

The Beardless Ophidium was first added to the catalogue of British Fishes by Pennant, to whom it was communicated by the Duchess of Portland: the specimen was found near Weymouth. Pennant gave a figure of his fish in the Appendix to the fourth volume of the British Zoology, edition of 1777, but no description. Colonel Montagu afterwards obtained a specimen on the south coast of Devon, which is figured and described in the first volume of the Wernerian Memoirs, as quoted. The editor of the edition of Pennant's British Zoology, published in 1812, left out the figure of the Beardless Ophidium, given in the previous edition, but copied the figure and description of Colonel Montagu.

Never having seen a specimen of this fish, Colonel Montagu's figure and description are here given, with some additions to be hereafter explained.

"Length about three inches; depth about a quarter of an inch. The head is very obtuse, and rounded in front: eyes large, placed forward and lateral; irides dark, with a circle of silver round the pupil: mouth, when closed, inclines obliquely upwards; the lips are marginated: the gill-membranes inflated beneath. The body is ensiform, considerably compressed towards the tail, and in shape is not unlike that of *Cepola rubescens*, vol. i. page 224, of this work; the lateral line is nearly in the middle, originating at the angle of the operculum to the gills, but rather obscure: vent nearly in the middle: the pectoral fin is rounded; the dorsal fin commences immediately above the base of the pectoral, and is at first not so broad, and usually not so erect, as the other part: the anal fin commences at the vent, and, together with the dorsal, unites with the caudal fin, which is cuneiform, but obtusely pointed. The colour is purplish brown, disposed in minute speckles; and along the base of the anal fin are about ten small bluish white spots regularly placed, but scarcely discernible without a lens, and possibly peculiar to younger fishes: all the fins are like the body in colour, except the pectoral and caudal; the first is pale, the last is yellowish." The fin-rays in number are—

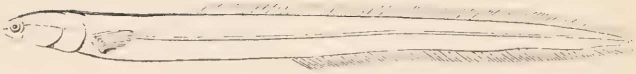
D. 77 : P. 11 : A. 44 : C. 18 or 20.

"This fish," Colonel Montagu observes, "does not appear to be very tenacious of life, like some of the Blennies, as it was placed in a tin box with the Crested and Smooth Blenny, covered with wet sea-weed, and although these were lively, the Ophidium was dead before it could be got to his house. It died with its mouth shut, the pectoral fins thrown forward, and the body curved a little near the vent, throwing the head upwards."

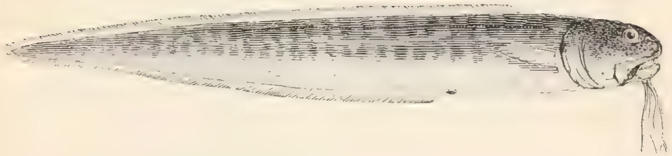
"Little can be said of the natural habits of this fish; but as it so rarely occurs, it is most probably an inhabitant of the rocky parts; in such a situation, at low-water, the specimen here described was taken."

But little being known either of Montagu's or Pennant's Ophidium, the figure at the head of this subject is taken from Montagu's figure, and the outline at the foot of this page is taken from Pennant's first figure, which Schneider appears to have adopted as the representative of the genus *Ophidium* in his Ichthyological work.

Never having seen either of these species, for they seem to be distinct, any information of their appearance on our coast is respectfully solicited by the author.



APODAL
MALACOPTERYGII. *MURÆNIDÆ.*



THE BEARDED OPHIDIUM.

Ophidium barbatum, Linn. Bloch, Ichth. pl. 159, fig. 1.
,, ,, *Bearded Ophidium,* Berken. Syn. vol. i. p. 66.
,, ,, ,, ,, Turton, Brit. Faun. p. 88.
,, ,, ,, ,, Jenyns, Brit. Vert. p. 481.
,, ,, *Donzelle commune,* Cuvier, Règne An. t. ii. p. 359.

The Bearded Ophidium, a well known Mediterranean species, has also been included by Berkenhout in his Catalogue of British Fishes; but whether on the personal authority of that author, or on what part of the British coast it was observed, or taken, no mention is made.

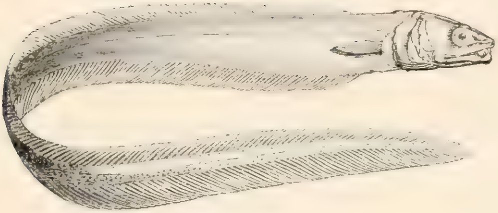
This fish was the subject of a paper by Dr. Broussonet, communicated by Sir Joseph Banks, read at the Royal Society, July 5th, 1781, and printed in the Transactions. The author traces this species from Pliny to Belon, Rondelet, Willughby, Artedi, Klein, Linnæus, Gouan, and Brunnich.

The form of the body is seen by the figure. The direction of the mouth is ascending; both maxillary bones are furnished with teeth; the barbule on the chin is single at its origin, is soon divided once, forming two, each of these are afterwards divided again, thus together producing the appearance of four barbules; the dorsal fin commences on a line nearly even with the end of the pectoral fin: the anal fin begins a little further backward; the scales are oval: the fish of a silvery flesh colour, appearing occasionally slightly mottled or spotted."

"This fish commonly grows to the size of eight or nine inches. It is found in most parts of the Mediterranean sea, and in great plenty in the Adriatic. It is taken by nets in Provence and Languedoc, together with many other small species which are not esteemed,—that is, what they call *Ravaillā.* In Languedoc the Ophidium is called *Donzella*, and this is the most common name for it on the coasts of the Mediterranean. In summer the Ophidium is common; its flesh is not of a good taste, rather coarse, as that of all the species of fishes which, having no ventral fins, are obliged to make great efforts in swimming, and have consequently the muscles harder. The want of ventral fins induces me to believe that it is not a migratory species. It feeds upon small crabs and fishes."

The vignette was copied from a sketch of a fishing party made by T. Stothard, R.A. about the year 1780.

APODAL
MALACOPTERYGII. *MURÆNIDÆ.*



DRUMMOND'S ECHIODON.

Echiodon Drummondii, Thompson, Proceedings Zool. Soc. 1837, page 55.
,, ,, ,, Transactions ,, ,, vol. ii. part iii. p. 207, plate 38.

Echiodon. *Generic Characters.*—Head oval; jaws furnished with large cylindrical teeth in front, other smaller teeth on the palatal bones and on the vomer. Gill-apertures large: branchiostegous membrane with seven rays. Body smooth, without scales, elongated, compressed. Dorsal and anal fins nearly as long as the body; all the rays soft; no ventral fins; anal aperture near the head.

A dead specimen of the fish figured above was found by Dr. J. L. Drummond on the beach at Carnclough, near Glenarm in the county of Antrim, in the month of June 1836, and from its appearance when found it was conjectured that it had been cast ashore by the tide of the preceding night, when a strong easterly wind prevailed. The specimen was given by Dr. Drummond to his friend Mr. W. Thompson of Belfast; and being new in form, was made by the latter gentleman the subject of a communication to the Zoological Society, which appeared in the Proceedings and Transactions of that Society as here quoted.

This specimen, Mr. Thompson observes, "being, so far as known to me, unique, I have been unwilling to injure its appearance by dissection. In external characters it is excluded from the *Ophidia* proper in consequence of not having the barbules; and though agreeing with the *Fierasfers* in the negative character of wanting these appendages, yet, by having the dorsal fin strongly developed and elevated, it ranges not with them."

"Its want of the very obvious character of the *Ophidia*, renders all comparison with them unnecessary; but of two species belonging to the *Fierasfers*, and which approach the present specimen most nearly, I may state that it possesses many of the characters of the *Ophidium fierasfer* of Risso, but differs from that species in the teeth, (both jaws are described as armed with three rows of sharp and hooked teeth,) number of fin-rays, and some minor characters; besides, there is nothing said of the remarkable teeth terminating both jaws, as exhibited in my specimen. In the Règne Animal we again find an *Ophidium dentatum* described as having in each jaw '*deux dents en crochets*,' but no further details are given. In this only character, however, the *Ophidium dentatum* differs from my fish, which has four large hooked teeth in the upper and two in the under jaw."

"Although when this fish first came into my possession, I saw that it might be classed under the *Malacopterygii Apodes*, and be placed near *Ophidium*, I considered that in a natural arrangement it would best constitute a new genus of the family *Tænioidea* (Riband-shaped). In being apodal it was not excluded from this family, as two genera belonging to it are destitute of ventral fins. I did not hesitate to place it under the *Acanthopterygii*, as some genera which are included in this order are, like it, strictly Malacopterygian, their natural connexion with genera having fins with spinous rays being considered—and in my opinion most philosophically—to outweigh this character; and further, I felt less reluctance in thus placing it, in consequence of *Cepola rubescens*, which it assimilates in some respects, having but one spinous ray, and that in the ventral fin. At the suggestion of John Edward Gray, Esq. F.R.S. I have, however, reconsidered the subject, and have come to the conclusion here advanced."

As a difference of opinion may still exist with regard to the position of this genus, I think it due to Mr. Thompson to subjoin the observations originally made.

"Like certain other genera which are comprehended under *Acanthopterygii*, the first order of the osseous fishes, its fins are altogether destitute of spinous rays; but, like those alluded to, such as *Zoarcus*, &c. its other characters seem to point out the *Tænioides* as the family to which it belongs. Of the eight genera of *Tænioides* already known, viz. *Lepidopus*, *Trichiurus*, *Gymnetrus*, *Stylephorus*, *Cepola*, *Lophotes*, *Trachypterus*, and *Alepisaurus*, the specimen under consideration agrees with *Trichiurus* and *Stylephorus* in being apodal, or wanting ventral fins, but in this character only is there any generic accordance. Though considerably more elongated, from the head posteriorly it approaches most nearly to *Cepola rubescens* in the form of the body, and in the forward commencement of the anal fin, which, with the dorsal, is prolonged until it joins the caudal; but it is only in the continuity of these fins until this junction is effected that the resemblance holds, as in my specimen, the dorsal rays, the five foremost of which are very short, increase in length posteriorly, and near the caudal fin are about three times as long as the depth of the body beneath them; in the anal fin, which is throughout much deeper than the dorsal, the rays likewise increase posteriorly; and near the caudal are in length four times greater than the depth of the body at the same place. The length of the posterior rays of these fins causes the dorsal, anal, and caudal, to appear as one; whilst, though they do join in *Cepola rubescens*, the last ray of the dorsal and anal being much shorter than the outer rays of the caudal, may at the same time be said to mark distinctly the termination of each fin. In my specimen the anal fin originates two lines in advance of the dorsal fin."

In the form of the head, and in dentition, it differs so remarkably from all the other genera as to render a comparison with them unnecessary. Its absolute characters must suffice for distinction.

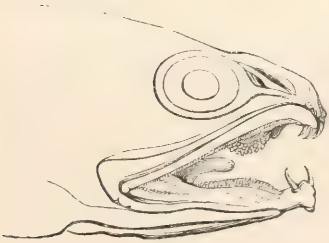
Description.—"Total length eleven inches; greatest depth at one inch four lines from the snout, six lines, thence posteriorly gradually narrowing; greatest breadth of body anteriorly three lines; at the middle of the entire length one line, and thence to the tail becoming gradually more compressed. Head one inch two lines long, or rather more than one-ninth of the entire length; profile sloping forward equally on both sides to the snout, which is truncated, and projects one line beyond the lower jaw; narrow, increasing in breadth very gradually from the snout, its breadth compared to its length as one to three and a half; height half its length, compressed at the sides, and rather flat above from the eyes backward; from the eyes forward a central bony ridge: snout viewed from above somewhat bifid, in consequence of the forward position of the large teeth on each side. A few large punctures extend from the snout below the eye, and are continued just behind it; a series of small ones closely arranged extend from the upper portion of the eye in a curved form posteriorly to near the edge of the preopercle, and thence a double row extends downwards. Nostrils very large, placed just in advance of, and before the centre of, the eye, and in form a somewhat oval transverse aperture. Eye large, occupying the entire half of the depth of the head; its width greater than its height; in the length of the head occupying the place of one in four and a half; its distance from the snout three lines, or equal to its diameter, consequently two and a half of its diameters are contained between it and the edge of the operculum. Operculum rounded at the base, terminating in a minute point directed backwards, strongly radiated, striæ distant; preoperculum ascending vertically; cheeks smooth and soft. Mouth rather obliquely cleft. Teeth, two large strong ones, placed close together, and curving inwards at each side the extremity of the upper jaw, the two inner one-sixteenth of an inch apart. In the lower jaw one slender rounded tooth, nearly one line long on each side, curving outwards at the base, and inwards at the point. Entire upper and under jaw and vomer densely studded with small bluntish teeth, somewhat uniform in size; vomer extending far forward, and very much developed, forming a cavity in the lower jaw, and in advance of the tongue when the mouth is closed; a series of rows of teeth similar to those last described on the palatal bones: all the teeth of the upper jaw exposed to view when the mouth is closed. Tongue short, not reaching within two lines and a half of the extremity of the lower jaw, and apparently toothless. On the dorsal ridge, one inch from the snout, or two lines and a half behind the cranium, is a short, stout, bony spine, not very conspicuous, and, excepting at its extreme point, covered with skin: it is six lines in advance of the first ray of the dorsal fin. Scales none, but it may have been divested of them during its short exposure on the beach. Lateral line inconspicuous, being a slight depression extending in a straight line along the middle of the sides posteriorly, or throughout the greater portion of its length, but anteriorly nearer to the dorsal than the ventral profile. Vent one inch three lines from the extremity of the lower jaw. Branchiostegous membrane opens forward rather before the extremity of the gape. Dorsal fin commencing one inch six lines from the snout, low at its origin, but gradually increasing in height to near the caudal fin, which it joins, the two or three anterior rays, which are very short, flexible and simple, the remainder articulated. Anal fin originates just behind the vent, or at one inch three lines from the point of the lower jaw, joins the caudal fin, near to which it increases in depth posteriorly from its origin, deeper than the dorsal fin throughout; at about one inch and a half from the caudal fin the rays are in length four times greater than the depth of the body at the same place, the rays of the dorsal fin opposite being three times the depth of the body; the first and second anterior rays flexible and simple, the remainder articulated. Pectoral fins originate one line behind the head, and are equal to half its length, central rays longest, all very flexible, placed below the middle of the sides. Caudal fin, central rays longest. Articulations very long on the rays of all the fins; no branched rays in any one of them.

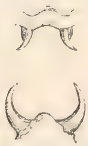
B. 7 : D. 180 : P. 16 : A. 180 : C. 12.

The number of the fin-rays were reckoned with the greatest care; but without injury to the specimen they could not be ascertained with certainty to a single ray. The vertebræ, which distinctly seen through the skin can be reckoned with accuracy, ninety-eight. Colours, anterior half a dull flesh colour, similar to specimens of *Cepola rubescens* preserved in spirits, hence it is presumed to have been originally red; behind this portion reddish-brown markings appear on the body at the base of the dorsal and anal fins, and suddenly increase in number, until from an inch behind the middle, the whole sides are closely marked and spotted over; the entire top and the sides of the head before the hinder line of the eye are similarly spotted; just behind the cranium a few spots also appear; the posterior rays of the dorsal and anal, and the entire caudal fin, blackish. Irides, operculum, and under surface, a short way beyond the vent, bright silver."

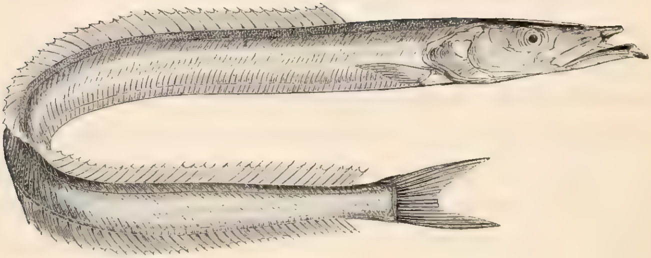
"The two large teeth, resembling serpent's fangs, which terminate the upper jaw on each side, have suggested the generic appellation of *Echiodon;* and the specific name of Drummondii is proposed in honour of its discoverer."

The figures below represent a side view of the head, the mouth open to show the form and situation of the teeth, enlarged; and a front view of the anterior terminal teeth, also enlarged. The illustrations here used are derived from Mr. Thompson's paper in the Transactions of the Zoological Society already quoted; and I with pleasure avail myself of the opportunity in this instance afforded me of recording my obligations to Mr. Thompson for his kind and zealous cooperation in zoology, and particularly for the loan of this rare specimen, and many other Irish fishes, for examination.





APODAL MALACOPTERYGII. *MURÆNIDÆ.*



THE SAND-EEL.

HORNELS, (HORNEELS ?) *Edinburgh.*

Ammodytes Tobianus, *Le Lançon*, CUVIER, Règne An. t. ii. p. 360.
,, ,, LINNÆUS. BLOCH, pt. iii. pl. 75, fig. 2.
,, *Anglorum verus*, *True Sand-Eel*, JAGO. RAY, Syn. p. 165, pl. 2, fig. 12.
,, *Tobianus*, *Wide-mouthed Launce*, JENYNS, Man. Brit. Vert. p. 482, sp. 170.
,, *Sand-Eel*, DON. Brit. Fish. pl. 33?

AMMODYTES. *Generic Characters.*—Head and body elongated; gill-openings large; dorsal fin extending nearly the whole length of the back; anal fin of considerable length; dorsal and anal fins separated from the caudal fin.

WE are indebted, says Baron Cuvier, to M. Lesauvage, of Caen, for pointing out the true distinctions in the two species of Ammodytes belonging to the shores of the Channel, *A. Tobianus* and *A. Lancea*, the first of which is rare, but the second very common.

Our excellent naturalist and countryman Ray, has given us, in his Synopsis, from Jago's Catalogue of Cornish Fishes, a good figure of the true *Tobianus*; but it was not, I believe, till the recent publication of Mr. Jenyns' valuable Manual of British Vertebrate Animals, that any English Zoologist had admitted two species among British Fishes. Shaw, in his General Zoology, vol. iv. p. 81, plate 9, has figured both species, but with only one name, and but one description.*

Ray, in his short notice from Jago's Catalogue, calls his *Ammodytes Anglorum verus* the true Sand-Eel; and his figure leaves no doubt that his fish is the same as the *Tobianus* of Linnæus, Bloch, and others. In the late Colonel Montagu's copy of Berkenhout's Synopsis of the Natural History of Great Britain, there is a note in Montagu's writing, which states, "That at Teignmouth a distinction is made between the Sand-Eel and Sand-Launce, by the size and superior length of the head and gills in the one; it is also said to be much more rare." The rarity and greater length of the head are both on the side of the *Tobianus*, the Sand-Eel, which, as far as my own observation goes, is much more scarce than the smaller-sized species with the shorter head; I am therefore desirous of preserving the distinctive appellation of Sand-Eel to the longer fish, *A. Tobianus*, and continuing that of Sand-Launce to the smaller species, bearing among naturalists the specific name of *Lancea.*

M. Lesauvage gave the name of *lanceolatus* to the species which had been previously called *Tobianus*, his trivial name will therefore only be used as a synonym.

Willughby's figure, G. 8, f. 1, appears to have been copied from Salvianus, and represents an *Ammodytes* with two small dorsal fins; I have not, therefore, referred it to either of our fishes.

The Sand-Eel is immediately to be distinguished from the Sand-Launce by its greater size, specimens now before me measuring twelve inches in length; Ray's fish was fifteen inches and a half long: it is further distinguished by the greater length of the head, and particularly of the lower jaw; by the commencement of the dorsal fin being on a line with the end of the pectoral fin-rays: the dorsal fin of the Sand-Launce beginning in a line with the middle of the pectoral fin, and the head smaller and shorter, as shown in the two representations here given. The Sand-Eel is browner in colour and less transparent in appearance, when in hand, than the Sand-Launce.

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* Both specimens are also figured by Klein.

The habits of the two species are in many respects very similar, and will be more particularly referred to under Sand-Launce, which being exceedingly common on all our sandy shores, has afforded greater opportunities for observation.

Both species of *Ammodytes* are included by Professor Nilsson among the fishes of Scandinavia; both species also occur in the Forth. Dr. Neill, in his account of the fishes of that locality, says, the Edinburgh fishermen call the large ones Hornels—probably an abbreviation of Horneels—in reference to the greater length of body and the horn-like elongation of the lower jaw, by means of which they are enabled to bury themselves in the wet sands of the sea-shore, from which they are scratched out with iron hooks for bait or sale.

Stephen Oliver the younger, in his agreeable Rambles in Northumberland and on the Scottish Border, when describing the fishing in the Tyne, says, Sand-Eels follow the young fry of the Coalfish into the harbour, and are frequently caught with the same bait as the Poodlers (young Coalfish), which is used in a manner similar to fly-fishing for Trout. The common length of the Sand-Eel in the Tyne is from twelve to fourteen inches; and their jaws, by a peculiar conformation, admit of great expansion. They swim rapidly, and dash at a shoal of fry with the voracity and swiftness of a Pike. Mr. Couch says that a large specimen caught on a line by a Cornish fisherman had a small fish of its own species in its stomach. Both species occur on the sandy parts of the coast of Sussex, Hampshire, Dorsetshire, and Devonshire.

Mr. Thompson has recorded the Sand-Eel as taken in the North of Ireland. A species of *Ammodytes* is taken at Newfoundland and at New York, but what species it is remains uncertain; Dr. Storer has, however, obtained the Sand-Eel, *A. Tobianus*, in two localities near Boston.

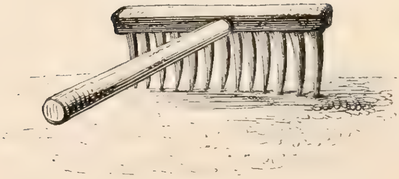
From the extreme point of the lower jaw to the posterior end of the gill-cover is to the whole length of the fish as one to four and a half; the depth of the body rather less than one-third of the length of the head; the lower jaw very much elongated, with a strong, indurated projection at the extreme tip; the upper jaw much shorter than the lower, with a strong forked tooth of two points descending from the vomer; the nostrils double; both open on each side on a line, one before the other, about half-way between the eye and the point of the nose: the eyes rather small; the posterior margin exactly half-way between the point of the under jaw and the posterior angle of the gill-cover: the shape of the body very nearly round; covered with small scales: the pectoral fin arises under the posterior angle of the gill-cover, its length one-third that of the length of the head; the dorsal fin placed in a groove, with a prominent line extending along each side; the rays commence in a vertical line over the end of the pectoral fin-rays, and end near the tail; the lateral line indented and straight; the abdomen with three indented parallel lines extending to the anal aperture, which has another orifice behind it; along the whole line of the lower part of each side extends a narrow and slender membrane attached by one edge; the anal fin is about one-third of the whole length of the fish, ending short of the caudal fin, and nearly on the same plane as the dorsal fin; the tail forked.

The fin-rays in number are—

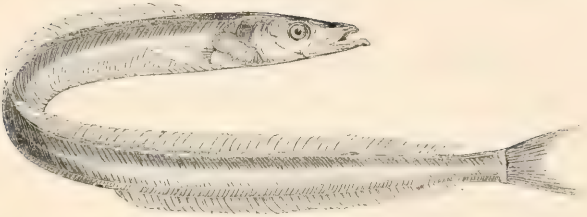
D. 55 : P. 15 : A. 29 : C. 17.

The irides, cheeks, gill-covers, lower part of the sides, and the abdomen, bright silvery; upper part of the head, back, and sides, light brown, reflecting tints of blue and green when held in different positions.

The vignette below represents the form of rake used to obtain Sand-Eels and Sand-Launce on some parts of the coast. A piece of strong iron wire, bent into the form of a sickle is, however, the more common instrument used.



APODAL
MALACOPTERYGII. *MURÆNIDÆ.*



THE SAND-LAUNCE.

THE RIGGLE, *Sussex coast.*

Ammodytes Lancea, *L'Equille,* Cuvier, Règne An. t. ii. p. 360.
,, ,, *Small-mouthed Launce,* Jenyns, Man. Brit. Vert. p. 483, sp. 171.
,, *Tobianus, Sand-Launce,* Penn. Brit. Zool. vol. iii. p. 206, pl. 28.
,, ,, *Common Launce,* Flem. Brit. An. p. 201, sp. 113.

The Sand-Launce, as previously stated, is very abundant on many parts of the shore of the British Islands. On account of its silvery brightness, it is in great estimation and constant use with fishermen as bait for the hooks of their sea and hand lines; and the habit peculiar to the species of burying themselves in the wet sand as the tide recedes affords easy means of capture. The generic term *Ammodytes* refers to this power of digging in sand. With the projecting portion of the under jaw, aided by the muscular power of the fish, and its slender form, it is enabled to bury itself with rapidity five or six inches deep in the soft sand as the ebbing sea retires, and releases itself again on the approach of the ensuing flood-tide, apparently uninjured, though deprived of water for several hours: another instance of a low degree of respiration and great tenacity of life in a genus of fishes having very large gill-apertures.

In Orkney, Mr. Low says it is constantly used as a bait for other fish, and though of good flavour, is very seldom eaten. On the sands at Portobello, near Edinburgh, as well as at other localities in that vicinity, people of all ages may be seen, when the tide is out, diligently searching for the Sand-Launce, and raking them out with iron hooks. Some are used as bait; but many are prepared for table, and considered delicate food.

Colonel Montagu mentions the Sand-Launce as being extremely plentiful at Slapton Sands, on the south coast of Devonshire, where the fishermen employ a small seine with a fine mesh, and are frequently so successful, that six or seven bushels are taken at one haul: these are usually sold to Dieppe fishermen for twenty-pence the bushel. Montagu adds, that on the part of the Devonshire coast here referred to, even the poorest people would not eat the Sand-Launce, while at Teignmouth it was in great request as food, and was counted out for sale by the score.

" It is only of late," says Mr. Couch, " that naturalists have learned to recognise two species, though it has been done long since by fishermen, who have been accustomed to observe that a small species, which keeps in larger bodies, and seldom goes far from land, is more followed by Mackerel than the others, and that its presence is a better sign of good fishing. On a calm evening it is an interesting sight to see the surface of the water broken by the repeated plunges of voracious fishes as they burst upon the little schull of Launces from beneath. Their only certain place of refuge from these pursuers is the sand."

I have obtained the fry of the Sand-Launce four inches long in the month of April, and considered them to be the young of the preceding year. May, August, and December, have each been named as the month in which the adult fish deposit their spawn; but the habits and economy of the two species have been greatly confounded hitherto, under the supposition that they were but examples of the same fish, differing only in size.

The Sand-Launce has been noticed on the coasts of the counties of Londonderry, Antrim, Dublin, and Cork; I learn also from F. C. Lukis, Esq. that both species are found at Guernsey; but that *Lancea* is the most common. The search for them in the sand prevails there, but it is usually made on moonlight nights.

Dr. Richardson includes this species in his Fauna-Boreali-Americana, and I have seen a specimen that was brought from Iceland by Mr. Proctor.

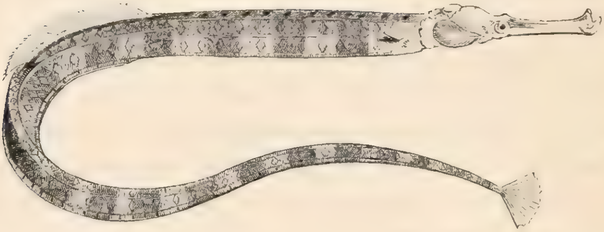
The food of the Sand-Launce is marine worms and very small fishes.

The usual length of this species is from five to seven inches: the length of the head compared to the length of the fish is less than as one to five: the lower jaw shorter in proportion than in the other species; the protractile portion of the upper jaw much more free to move, and when the lower jaw is pressed down, this moveable part comes forward and downward: the posterior margin of the eye is less than half-way between the point of the lower jaw and the posterior projecting angle of the gill-cover, being placed nearer the nose than in *Tobianus;* the dorsal fin commencing in a line over the middle of the pectoral fin.

The fin-rays in number are—

D. 51 : P. 13 : A. 25 : C. 15.

LOPHOBRANCHII. *SYNGNATHIDÆ.**



THE GREAT PIPE-FISH.

Syngnathus Acus, Linnæus. Bloch, pt. iii. pl. 91, fig. 1, young; fig. 2, adult.
,, ,, *Longer Pipe-fish,* Penn. Brit. Zool. vol. iii. p. 184, pl. 26. Two figures; upper, female; lower, male.
,, ,, *Pipe-fish,* Flem. Brit. An. p. 175, sp. 34.
,, ,, *Great Pipe-fish,* Jenyns, Man. Brit. Vert. p. 484, sp. 172.

Syngnathus. *Generic Characters.*—Body elongated, slender, covered with a series of indurated plates arranged in parallel lines; head long; both jaws produced, united, tubular; no ventral fins. In the species of the first division, an elongated pouch under the tail in the males only, closed by two folding membranes.

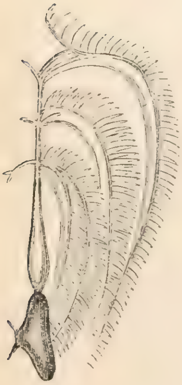
In the species belonging to this family the jaws are united, forming a tube more or less cylindrical. The gills, instead of having the pectinated appearance so well known to exist in the fishes previously described, are separated into small rounded tufts, which are arranged along the branchial arches, and the fishes of this family are therefore called *Lophobranchii.*

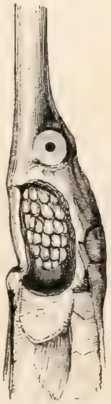
* The family of the Pipe-fishes.

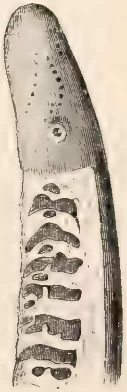
The figure on the left hand of the vignette at the bottom of the page, represents one side of the pectinated gills of a Pike; that in the centre is drawn from the head of a specimen of *S. acus*, to show the gills in small tufts, the operculum being removed: the right hand figure exhibits the head of the river Lampern, part of the skin on the side of the neck being removed to show another form of branchial apparatus, in which portions of the gills occupy different cells. The fish will be described hereafter, and this structure referred to.

These delicate tufts in the Pipe-fishes are defended externally by a large and hard operculum, having an aperture in the connecting membrane at its upper and posterior part. The fishes of this limited family are further remarkable for the extreme tenuity of their bodies, as well as for the number and arrangement of the indurated and sculptured plates by which their lengthened bodies are defended. They are frequently called Needle-fish.

The six species of British *Syngnathi* require to be ar-







ranged in two divisions; the first of which includes two marsupial Pipe-fish, *S. acus* and *S. typhle*, having true caudal fins: four ophidial Pipe-fish, which may be again divided into two sections, the first of which contains two species, *S. æquoreus* and *S. anguineus*, having each a rudimentary caudal fin; the second section, also containing two species, *S. ophidion* and *S. lumbriciformis*, in which there is no rudimentary caudal fin, the round tail ending in a fine point.

The natural history of the *Syngnathi* appears not to have been so well understood, nor the species so clearly defined by the older authors as those of many other genera. By giving, in this work, figures taken from the specimens, and adding besides, as vignettes, enlarged representations of those parts which assist in determining specific distinction, six species, it is hoped, will be made out; and only those actually obtained on the British coast, and of which specimens are preserved, will be included. They are all marine.

Syngnathus acus, or the Great Pipe-fish, is one of the most common species, and is found on many parts of the coast, sometimes at low-water among seaweed, at other times in deep water. It is believed that the habit of proceeding to deep water at two different periods of the season has reference to important and interesting changes connected with the production of the young.

In a MS. History of British Fishes, written by the late John Walcott, Esq.* during his residence at Teignmouth in the years 1784 and 85, and which has been most kindly lent to me by his son, William Walcott, Esq. with liberty to make any use of it in the present work, I found a statement in reference to the sexes of *S. acus*, which has since been confirmed by four Continental naturalists, and which

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* Author of various published works on Natural History.

I have verified by repeated examinations. Mr. Walcott's observation is as follows :—

"The male differs from the female in the belly from the vent to the tail fin being much broader, and in having for about two-thirds of its length two soft flaps, which fold together, and form a false belly (or pouch). They breed in the summer ; the females casting their roe into the false belly of the male. This I have asserted from having examined many, and having constantly found, early in the summer, roe in those without a false belly, but never any in those with ; and on opening them later in the summer, there has been no roe in those which I have termed the female, but only in the false belly of the male."

On dissecting males and females the proof of the correctness of this new view was obvious. The anal or sub-caudal pouch is peculiar to the males only, and is closed by two elongated lateral flaps. On separating these flaps, and exposing the inside, the ova, large and yellow, were seen lining the pouch in some specimens, while in others the hemispheric depressions from which the ova had been but recently removed were very visible. In each of these the opened abdomen exhibited true male organs. The females examined had no anal pouch, and the opened abdomen exposed two lobes of ova of large size. In a specimen of a male of *S. acus*, obtained at Dover on the 20th of July 1835, and for which I am indebted to W. Christy, Esq. the opened abdomen exhibited the preparatory organs of the male ; and the displayed sub-caudal pouch showed many eggs contained in it, the young of which were fully developed, and ready to escape from the capsules, while from others the young had actually escaped. They were rather more than one inch in length, and slightly barred with brown.

In the plate devoted to *Syngnathi*, in the last two octavo editions of Pennant's British Zoology, the upper figure represents the female, and the second figure the male of *S. acus*. The enlargement on the under surface of the second figure, looking like an elongated fin, marks the situation of the distended pouch of a male. Pennant's third figure is the *S. anguineus*, and the fourth the *S. lumbriciformis* of this work. Neither *S. typhle* nor *S. æquoreus* are figured in the British Zoology.

At what time or in what manner the ova are transferred from the abdomen of the female to the sub-caudal pouch of the male is, I believe, unknown.

Mr. Walcott also adds, in his MS. that *S. acus* begins to breed when only four or five inches long. This I have also obtained proof of; and although examples of this species not uncommonly occur of eighteen inches long, and Bloch attributes to it a length of two to three feet, I have a specimen, four inches long only, a young fish apparently of the preceding year, in the opened abdomen of which the ova, in two small lobes, are full grown.

M. Risso notices the great attachment of the adult Pipe-fish to their young, and this pouch probably serves as a place of shelter to which the young ones retreat in case of danger. I have been assured by fishermen that if the young were shaken out of the pouch into the water over the side of the boat, they did not swim away, but when the parent fish was held in the water in a favourable position, the young would again enter the pouch.

The figures of *S. acus* and *typhle* are correctly represented by Rondeletius, and the characteristic difference in the form and size of the tubular mouth in each is well preserved. Below the figure, in that work, of the species now under consideration here, several of the young are represented as swimming near the abdomen of the parent fish. This figure of Rondeletius is copied in Willughby, plate I. 25, fig. 6.

Mr. Couch says, "This species may be seen slowly moving about in a singular manner, horizontally or perpendicularly, with the head downwards or upwards, and in every attitude of contortion, in search of food, which chiefly seems to be water insects."

From the great similarity in the form and size of the mouth in all the species, it is probable that their food is also similar. Worms, small mollusca, young and minute thin-skinned crustacea, and the ova of other fishes, are among the substances taken ; and these *Syngnathi* are supposed to be able, by dilating their throat at pleasure, to draw their food up their cylindrical beak-like mouth, as water is drawn up the pipe of a syringe.

From the point of the tubular mouth to the posterior edge of the indurated portion of the operculum, the length is, when compared to the whole length of the fish, as one to eight ; if measured to the edge of the shoulder, it is as one to seven and a half, and this proportion exists in specimens of various ages or lengths, from six inches to eighteen ; from the mouth to a projecting point at the anterior edge of the eye, and thence to the origin of the pectoral fin, the distances are equal : the jaws united, tubular, slightly compressed ; in depth but one-third that of the head at its deepest part, which is in a vertical line with the centre of the operculum : the mouth small, placed at the extremity of the tube, opening obliquely upwards ; the lower jaw the longest : eyes rather large, bony orbits prominent : operculum covered with radiating striæ : the head between the eyes flattened ; behind the eyes, rising into a keel-like crest, which reaches to the neck : from the pectoral fin to the anal aperture the body is deepest and heptangular, with three ridges along each side, and one along the abdomen, which ends at the vent ; the surface defended by a series of nineteen plates ; throughout the short extent of the dorsal fin the body is hexangular, the ridge of the abdomen being discontinued ; thence to the end of the tail, tapering, slender, and quadrangular, with a series of forty-four plates; the pectoral fins are small; the dorsal fin commences at two-fifths of the whole length of the fish, and in a vertical line rather before the anal aperture; the longest rays not equal in height to the depth of the body; the anal fin very small; the tail rounded and fan-shaped.

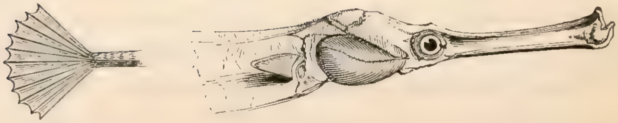
The fin-rays in number are—

D. 40 : P. 12 : A. 4 : C. 10.

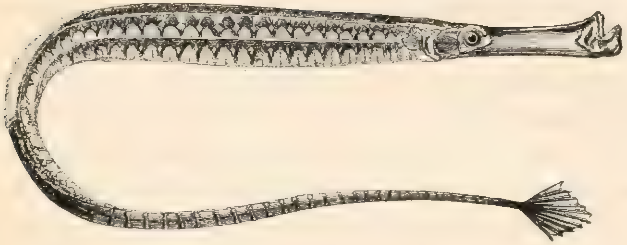
The prevailing colour is pale brown, transversely barred with darker brown.

The vignette below represents the head and tail of the Great Pipe-fish from a larger specimen than that which is figured entire.

This species appears to be common on the shores of the British Islands generally.



LOPHOBRANCHII. *SYNGNATHIDÆ.*



THE DEEP-NOSED PIPE-FISH.

Syngnathus Typhle,	Linnæus.	
Acus Aristotelis,	*Typhle Antiquorum,*	Willughby, p. 158, I. 25, fig. 1.
Syngnathus Typhle,	*Shorter Pipe-fish,*	Don. Brit. Fish. pl. 56.
,, ,,	,, ,,	Flem. Brit. An. p. 175, sp. 35.
,, ,,	*Lesser Pipe-fish,*	Jenyns, Man. Brit. Vert. p. 485, sp. 173.

The Deep-nosed Pipe-fish is immediately distinguished from the preceding species by the more compressed form of the jaws, which are also so deep that the upper and lower edges are nearly parallel with the lines of the upper and under surface of the head. From the two large-sized Pipe-fish of the next division this species is easily known by the presence of pectoral, anal, and caudal fins. The figures in the works of Willughby and Mr. Donovan are good representations; but I believe the figure in Bloch, part. iii. plate 91, f. 1, which has usually been considered and referred to as *Syngnathus typhle*, to be only a representation of the young of *S. acus.*

S. typhle has also been well figured by M. Laroche, in the Ann. de Mus. t. xiii. under the name of *S. Rondeletii.*

It is the *S. viridis* of M. Risso,[*] a term that seems liable to objection, even if a name were wanting, inasmuch as several other species are more or less green.

The Deep-nosed Pipe-fish does not differ materially in its habits, that I am aware of, from the species last described. The ova are transferred from the abdomen of the female to the sub-caudal pouch of the male, and there hatched in the same manner. When fishing in ten or twelve feet water over a soft surface covered with weeds, using the small net described and figured in vol. i. page 248, I have taken both sorts together, finding the deep-nosed species abundant on the Dorsetshire coast.

Dr. Parnell has obtained this species in the Forth; Mr. Couch includes it in his Cornish Fauna, and Mr. Thompson has found it in two localities on the coast of Ireland.

The whole length of the largest specimens I have seen was thirteen inches; from the point of the closed jaws to the posterior end of the indurated portion of the gill-cover, the distance is, compared to the whole length of the fish, as one to six; the head larger than in *S. acus*, and without the elevated ridge on the top of it; the distance from the point of the upper jaw to the projecting tubercle in front of the eye, and thence to the end of the pectoral fin, equal; the united jaws are very much compressed, and nearly as deep as the head, only slightly inclining to a slope before the eyes; the body hexangular; the middle lateral angle on each side becoming the upper angles of the quadrangular tail at the end of the dorsal fin. This fin commences farther back than in *S. acus*, the middle of the dorsal fin being very nearly the middle of the whole length of the fish; the series of indurated plates between the shoulder and the vent includes eighteen, thence to the end of the tail about thirty-seven;

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[*] Figured by M. Guerin, in illustration of the genera of the *Règne Animal, Poissons*, pl. 65, fig. 1.

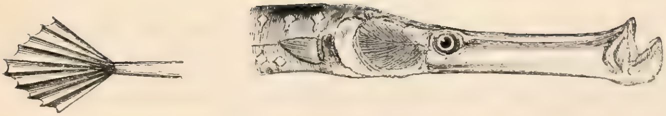
but both series are liable to a little variation in the number of these sculptured plates: the abdomen is almost rounded; the anal fin minute; the caudal fin pointed; the two central rays the longest; the others graduated.

The fin-rays in number are—

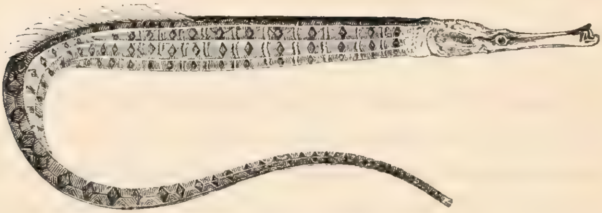
D. 39 : P. 15 : A. 3 : C. 10.

The prevailing colour is olive green, mottled and spotted with yellow brown and yellowish white.

As mentioned in the account of the Great Pipe-fish, last described, the Deep-nosed Pipe-fish, *S. typhle*, is well figured in the work of Rondeletius. The vignette below represents the head and tail of this species of larger size than the block of the whole fish would admit.



LOPHOBRANCHII. *SYNGNATHIDÆ.*



THE ÆQUOREAL PIPE-FISH.

Syngnathus æquoreus, Linnæus.
,, ,, *Æquoreal Pipe-fish*, Montagu, Wern. Mem. vol. i. p. 85, pl. 4, fig. 1.
, ,, ,, ,, Penn. Brit. Zool. vol. iii. p. 188.
,, ,, ,, ,, Flem. Brit. An. p. 176, sp. 38.
,, ,, ,, ,, Jenyns, Man. Brit. Vert. p. 486, sp. 174.

Characters.—The species belonging to the second division of the genus *Syngnathus* have a dorsal fin only; no pectoral, ventral, anal, or true caudal fins; the latter being only rudimentary in the first two species, and entirely wanting in the other two; no sub-caudal pouch in either sex.

Of this division the British shores produce four species, the largest of which, the Æquoreal Pipe-fish, was described at length by Colonel Montagu from two specimens obtained on the Devonshire coast. It had been noticed as long ago as 1684 by Sir Robert Sibbald, in his *Scotia Illustrata*, part ii. book 3, page 24, who attributes to it a length of two feet.

Of this species I have not succeeded in taking any example; but I possess four, for one of which I am indebted to the kindness of Mr. Embleton, of the Berwickshire Naturalists'

Club, who obtained it on the coast of Berwickshire, for the second to Mr. Couch, and two from Mr. Wallace of the Isle of Man. This species has also been taken by Mr. Selby on the coast of Northumberland. By communication from F. C. Lukis, Esq. I learn also, that this species, which I believe to be rare in England, occurs at Guernsey.

I can add but little to the description of Montagu, and shall therefore adopt it, with some slight modifications.

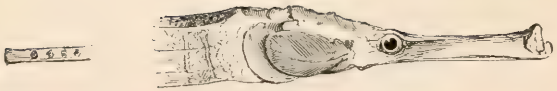
" Length twenty inches and a half, viz. ten to the vent, and ten and a half to the end of the tail ;" the length of the head is to the whole length of the fish as one to twelve : " the snout is similar in form to that of *S. acus ;* its length to the eye three-quarters of an inch ; from thence to the end of the gill-cover, including the eye, one inch : the form of the body is rather compressed and angular, with an acute dorsal and abdominal ridge, which, together with three slight angles on each side, give it an octangular appearance : it is of equal size from the gills to the vent, which part contains about thirty plates ; from the vent to the extremity of the tail it is first quadrangular, and towards the end, round and taper, containing about thirty-six plates : immediately behind the vent, the body of this specimen suddenly decreases to one-third less in diameter ; but this may be a sexual distinction."

" The dorsal fin consists of forty rays, commencing in a vertical line considerably before the vent, and terminating behind it, so that three-fourths of the fin is before the ventral aperture. The end of the tail is extremely small and compressed, the rays of which are not visible to the naked eye. The colour is yellowish, with transverse pale lines and dark margins, one in each joint, and another down the middle of each plate, giving it the appearance of possessing double the number of joints it really has ; these markings, however, cease at the vent."

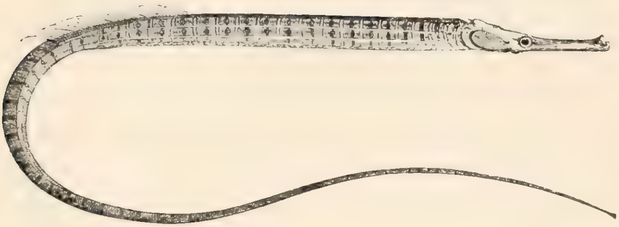
Mr. Couch, it appears, has not seen more than two or three specimens; but the Cornish fishermen say they find this species from ten to fifteen leagues from land, and in fine weather swimming at the surface over a depth of fifty fathoms or more. This species has also been taken on the south-west coast of Scotland, in Ireland, and at the Isle of Man.

Examples of this species being rare, the sexual peculiarities of this division of the *Syngnathi* will be explained when describing the next species.

The vignette below represents the head and tail of this species on a larger scale.



LOPHOBRANCHII. *SYNGNATHIDÆ.*



THE SNAKE PIPE-FISH.

Syngnathus	*anguineus,*	*Snake Pipe-fish,*	Jenyns, Cat. Brit. Vert.
,,	*ophidion,*	*Serpent de Mer,*	Bloch, pt. iii. pl. 91, fig. 3.
,,	,,	*Snake Pipe-fish,*	Shaw, Gen. Zool. vol. v. p. 453, pl. 179.
,,	,,	*Longer Pipe-fish,*	Low, Faun. Orcad. p. 179, sp. 1.

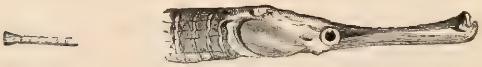
No species of *Syngnathus* can better deserve the name of *anguineus*, little snake, than the present. It is immediately distinguishable from the fish last described, with which alone it is likely to be confounded, by its much more slender as well as rounder body, which scarcely exceeds a goose-quill in size, and by the whole of the dorsal fin being, in a specimen of fourteen inches long, more than half an inch before the middle of the fish. Pennant has figured this fish, No. 61 of plate 26, but not described it.

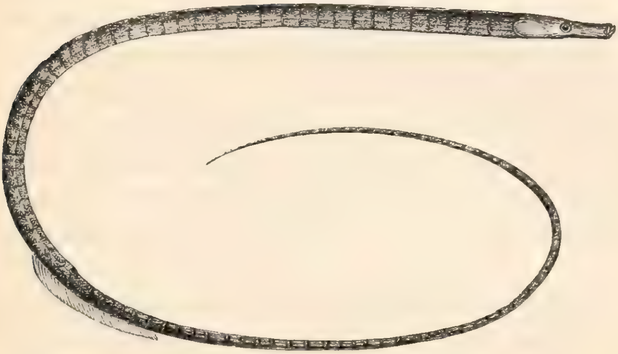
In this species, as well as the three others belonging to this second division, neither male nor female possesses an anal pouch, but the ova after exclusion from the abdomen of the female are carried for a time by the male in separate hemispheric depressions on the external surface of the abdomen, anterior to the anus. The females have no such depressions. The sexes have been determined by examination of the internal structure. All the specimens examined having these external hemispheric cells proved to be males, the testes in the abdomen obvious; those without external depressions proved to be all females, internally provided with two lobes of enlarged ova. The males of this species when taken by me as late in the season as August, had one ovum of the size and colour of a mustard-seed lodged in each cup-shaped cell. These specimens were caught with a keer-drag net between Brownsey Island and South Haven, at the mouth of Poole Harbour. Many specimens of *S. acus* and *typhle* were obtained at the same time and place.

This species has been taken in two or three different localities in Ireland.

The length of the head in this species is, compared to the whole length of the fish, as one to eleven; the form of the body slightly octangular, but more slender and rounded than in that last described; the body uniform in size as far as the vent, then tapering gradually to the tail, which has a slightly flattened end; the divisions in the series of transverse plates, and the angles of the body, almost obsolete; the dorsal fin, as before mentioned, entirely anterior to the middle of the fish; the number of rays thirty-eight: the vent in a line with the last fourth portion of the dorsal fin.

The colour of the body is a uniform olive green; the irides red, the pupils black. The specimens I possess vary in length from eight inches to fourteen inches.





THE STRAIGHT-NOSED PIPE-FISH.

Syngnathus ophidion, LINNÆUS, Syst. Nat. t. i. p. 417, sp. 5.
,, ,, ,, Faun. Suec. p. 131, sp. 1.
,, ,, *Worm Pipe-fish*, JENYNS, Brit. Vert. p. 488.

IT is only within a few years, I believe, that writers on the Natural History of European Fishes have become aware that in quoting, as was almost invariably the case, the figure of the *Syngnathus ophidion* of Bloch, tab. 91, fig. 3, as the true *ophidion*, they were not referring to, because that figure does not represent, the true *Syngnathus ophidion* of Artedi and Linnæus. The fish, as represented by Bloch, does not exhibit any appearance of a caudal fin, but if the species there figured from be examined, it will be found to possess a rudimentary caudal fin,* and could not therefore be considered as referred to by Linnæus in the short but expressive description, *S. pinnis caudæ ani pectoralibusque nullis, corpore tereti.*

The first good figure of the true *S. ophidion* of Linnæus that became known to me appeared in an octavo volume by M. C. U. Ekström, on the Fishes of Morko, in Sudermannland, a province in Sweden, published at Berlin in 1835, a copy of which came into my possession in the autumn of 1836. In 1838, a figure of the head of this fish appeared with others in M. Wiegmann's Archives of Natural History in illustration of a paper on the Swedish species of the genus *Syngnathus* by M. B. Fr. Fries of Stockholm; and this fish having been obtained on the British coast by others as well as by myself, I now insert a figure of it, of the natural size.

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* British Fishes, vol. ii. p. 446, vignette.

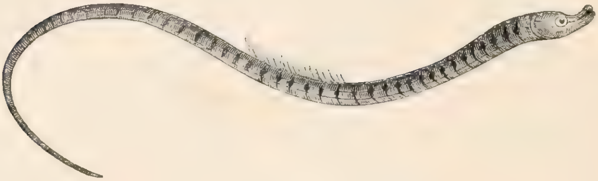
To this last division belongs the true *S. ophidion* of Artedi and Linnæus, the males of which in the season of reproduction carry the eggs, after deposition by the female, in three or four rows of hemispheric depressions on the under surface of their bodies. This species, which lives among the seaweed on our coast, is more rare than some others. It was found in Cornwall long ago by our countryman and naturalist John Ray, has been recently described by Mr. Jenyns in his "Manual of British Vertebrate Animals," from specimens obtained at Weymouth, and I also possess several specimens obtained on the Dorsetshire coast.

This little Pipe-fish is long, slender, and nearly cylindrical, but slightly compressed from the head to the anal aperture; from thence to the end of the tail round and tapering very gradually to a fine point; the head is short, the length of it only half an inch in a specimen of nine inches; the length of the head therefore, as compared to the whole length of the fish, is as one to eighteen; the nose is straight, rather compressed, a section forming a hexagon slightly elongated, of which the upper and under angles are the most produced; the distance from the point of the nose to the eye, and from thence to the hinder edge of the operculum, equal; no pectoral, anal, or caudal fin; the anal aperture is near the middle of the whole length of the fish, with a delicately-formed dorsal fin in a line over it, nearly one inch in length at its base, with about one-third of the fin, which contains from thirty-five to forty very slender rays, in advance of the vertical line of the anal aperture. Between the head and the anal orifice there are on the body of the fish about thirty sculptured plates or segments, and nearly sixty on the tail, diminishing gradually in size as they approach the tip.

Colour.—Some specimens are uniform olive green, others are tinged with yellowish brown, and both are occasionally varied with darker shades of colour on the body.

The largest specimens seldom exceed nine inches in length. The figure at the head of this subject is the exact size of the specimen from which it was drawn.

LOPHOBRANCHII. *SYNGNATHIDÆ.*



THE WORM PIPE-FISH.

Syngnathus lumbriciformis,		YARRELL.
Acus ,,		WILLUGHBY, p. 160.
Syngnathus ophidion,	*Little Pipe-fish,*	PENN. Brit. Zool. vol. iii. p. 187, pl. 26, No. 22.
,, ,,	,, ,,	FLEM. Brit. An. p. 176, sp. 39.

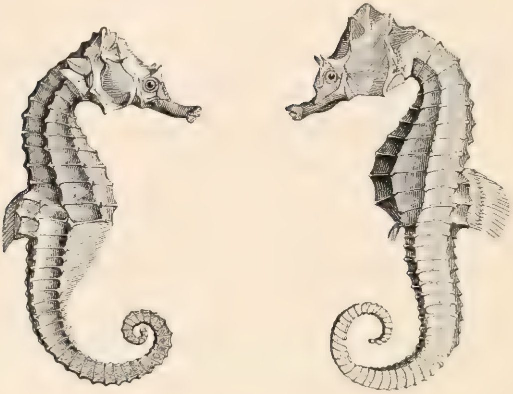
THE WORM-LIKE PIPE-FISH is the smallest of the British species, and is taken on various parts of the coast. Mr. Low describes it as found in Orkney under stones; and Mr. Couch finds it in similar situations on the coast of Cornwall, where it is considered common. Mr. Thompson has recorded it as occurring in three or four different localities on the coast of Ireland.

Pennant has figured this species with the ova attached to the under and external surface of the abdomen, as in the species last described. There is little doubt that the young are produced in the same mode as in the other species belonging to this division of the genus, and that the same sexual peculiarities exist. Pennant, not aware of the singular interchange which takes place, says, very naturally, " On the belly of the female is a long hollow, to which adhere the eggs, disposed in three rows."

This species does not exceed five inches or five inches and a half in length, and the wood-engraving at the head of the preceding page represents this fish but little less than its natural size. It possesses when adult no fin except that on the back, which in the specimen I examined contained thirty rays. The nose is very short, turned a little upwards; the eyes prominent; from the point of the jaws to the posterior edge of the orbit, and thence to the end of the operculum, the distances are equal; the length of these two portions together, compared to the whole length of the fish, is as one to twelve; the form of the body nearly cylindrical; the vent is situated at the end of the first third of the whole length, with a series of nineteen plates before it, and in a vertical line, with three-fourths of the dorsal fin behind it; from the vent the body tapers gradually all the way to the tail, which ends in a point; the number of plates forming the series between the vent and the tail-end, about fifty. The surface of the body is more smooth than in the two species previously described, and the colour is dark olive green.

In 1837 the late Professor B. Fries, of Stockholm, published an interesting paper on the metamorphosis which takes place in this species: an interesting fact hitherto unobserved to the same extent in the class of Fish, — namely, that the young of this species at their escape from the egg have the entire tail covered with a fin-like membrane, which extends partly up the back, and also along the under surface as far as the anal aperture: the little fish at this stage possesses also pectoral fins. Except the portion required to form the permanent dorsal fin, all these, at a subsequent unknown period, are thrown off in a way similar to that of the larvæ of frogs rejecting their tails. The absorption of the pectoral and caudal fins is the novelty in this case: the existence and subsequent absorption of part of the dorsal and anal membrane was previously known to occur in the young of the Salmon.

LOPHOBRANCHII. *SYNGNATHIDÆ.*



THE SHORT-NOSED HIPPOCAMPUS.

Hippocampus brevirostris, Cuvier, Règne An. t. ii. p. 363.
,, *Rondeletii*, Willughby, p. 157, I. 25, fig. 3.
,, *brevirostris*, *Sea-horse*, Jenyns, Man. Brit. Vert. p. 489, sp. 177.

Hippocampus. *Generic Characters.*—The jaws united and tubular, like those of the *Syngnathi;* the mouth placed at the end; the body compressed, short, and deep; the whole length of the body and tail divided by longitudinal and transverse ridges, with tubercular points at the angles of intersection; both sexes have pectoral and dorsal fins; the females only have an anal fin; neither sex has ventral or caudal fins.

Pennant, in the edition of his British Zoology, the three first volumes of which were published in 1776 and the fourth in 1777, states that he had been informed the *Syngnathus Hippocampus* of Linnæus, or what the English improperly call the Sea-horse, had been found on the southern shores of this kingdom. John Walcott, Esq. whose MS. History of British Fishes was written in the years 1784 and 1785, says, in reference to a drawing of a female specimen of what I believe to be the *Hippocampus brevirostris* of Cuvier, "This was taken on the coast of Hampshire, and given me by the late Mr. Brander."

L. W. Dillwyn, Esq. obtained a specimen of *Hippocampus*, some years ago, which was said to have been taken on the Dorsetshire coast; and Messrs. C. and J. Paget, in their sketch of the Natural History of Yarmouth, state that the *Hippocampus* is also occasionally met with there.

According to Mr. Thompson, a Hippocampus has been taken both in the north and the south of Ireland,—namely, at Belfast and Youghal. Dr. Storer includes the Short-nosed Hippocampus in his Catalogue of the Fishes of Massachusetts.

But the most valuable information I have received on this subject has been supplied by F. C. Lukis, Esq. of Guernsey, to whom I am indebted for the loan of the male and female specimens from which the figures at the head of the preceding page were taken.

By a comparison with M. Guerin's figure of the *Hippocampus brevirostris* of Cuvier's *Règne Animal*, I have little doubt that the two fishes here figured are examples of *H. brevirostris;* and Mr. Lukis, in the autumn of 1835, obtained two specimens of *Hippocampus* on the Hampshire coast, one of which is stated to be identical with those here figured: there can therefore be no doubt, from these various authorities, that at least one species is found on our coast, and that this species is also obtained at Guernsey and the other Channel islands.

The circumstance of the same species occurring at Guernsey and on our southern coast, gives additional value to the following communication. At the time of writing, June 9, 1835, Mr. Lukis had two female specimens of *Hippocampus brevirostris*, then healthy and active, which had been living twelve days in a glass vessel, their actions equally novel and amusing. "An appearance of search for a resting-place induced me," says Mr. Lukis, " to consult their wishes by placing seaweed and straws in the vessel: the desired effect was obtained, and has afforded me much to reflect upon in their habits. They now exhibit many of their peculiarities, and few subjects of the deep have displayed, *in prison*, more sport or more intelligence."

" When swimming about, they maintain a vertical position; but the tail is ready to grasp whatever meets it in the water, quickly entwines in any direction round the weeds, and, when fixed, the animal intently watches the surrounding objects, and darts at its prey with great dexterity."

" When both approach each other, they often twist their tails together, and struggle to separate or attach themselves to the weeds; this is done by the under part of their cheeks or chin, which is also used for raising the body when a new spot is wanted for the tail to entwine afresh. The eyes move independently of each other, as in the chamelion; this, with the brilliant changeable iridescence about the head, and its blue bands, forcibly remind the observer of that animal."

The vignette in illustration of the habits here described was copied from a drawing by Mr. Lukis, most obligingly lent me for this purpose.

By the kindness of William Walcott, Esq. I learn that a gentleman of the Island of Jersey, an attentive observer of nature, remembers having more than once seen specimens of *Hippocampus* curled up in oyster-shells. About four years since, a specimen was shown at Southampton, which lived more than a fortnight in a glass globe. This was said to have been obtained on the French coast near Granville, and was brought to Southampton by one of the sailors of a steam-packet; I have also heard of one that lived three weeks in confinement at Harwich, the undulating motion of which when swimming was performed with great ease, and was very interesting to observe.

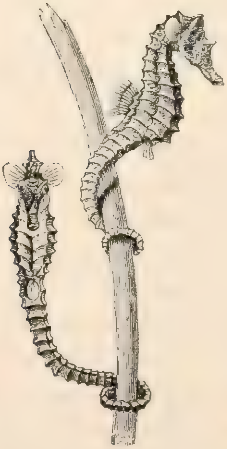
The species of *Hippocampus* in their sexual peculiarities, as far as they have been investigated, appear to coincide with those of the *Syngnathi.* I had the pleasure of looking over, with Mr. Owen, some specimens in the collection of the Royal College of Surgeons, which had been examined and the internal structure partly exposed to view by the dissections of John Hunter. The females with the abdomen enlarged, as shown in the right-hand figure at the head of this article, have a small anal fin of four rays, but no true pouch ; the ova in the abdomen. Males have no anal fin, in any of the specimens I have examined ; the pouch obvious ; the abdomen smaller than in the females, as shown in the left-hand figure. The two specimens represented in the vignette are both females.

Their food is unknown to me, but is probably very similar to that taken by the *Syngnathi.*

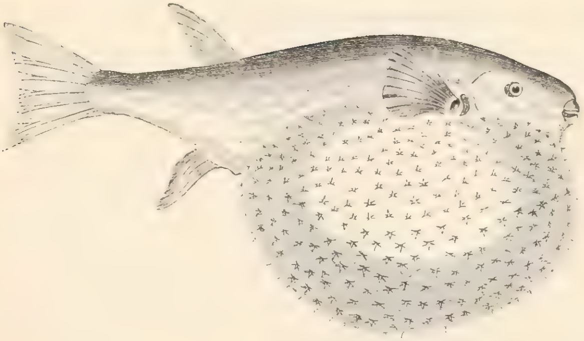
The whole length from the point of the nose to the end of the tail is about five inches : the connected jaws, forming a tubular mouth, are considerably shorter than the rest of the head : the eyes prominent, the irides straw yellow ; over each eye a single prominent spinous tubercle : the operculum covered with striæ, radiating from the front : the pectoral fins, placed immediately behind the operculum, are small, apparently containing about eight rays in each ; the form of the body heptangular, three angles on each side, the seventh longitudinal angular line being on the abdomen ; the back flat ; the transverse segments of the body eleven, with tubercular projections at the points of intersection ; the rays of the dorsal fin about sixteen : the anal fin is peculiar to the female only, and probably performs some office at the time of the transfer of the ova to the pouch of the male ; this anal fin contains four rays : the abdomen as deep again as the tail ; from the vent the form of the tail is quadrangular, ending in a point : the number of segments about thirty.

The general colour is a pale ash brown, relieved by a changeable iridescence, and variable tints of blue dispersed over different parts of the head, body, and tail.

I have not included any reference to Linnæus or Bloch in the synonymes, being doubtful that the species are identical with the one here described. Klein's figure, No. 10, very closely resembles the *H. brevirostris*; and by the description, the *H. antiquus* of Risso is also the *H. brevirostris* of Cuvier.



PLECTOGNATHI. *GYMNODONTIDÆ.*



PENNANT'S GLOBE-FISH.

Tetrodon Pennantii,	*Pennant's Globe-fish,*	YARRELL.
,, *stellatus,*	*Stellated* ,,	DON. Brit. Fish. pl. 64.
Tetraodon lævigatus,	*Globe Diodon,*	PENN. Brit. Zool. ed. 1776, vol. iii. p. 132, pl. 20.
Tetrodon lagocephalus,	*Globe Tetrodon,*	PENN. Brit. Zool. ed. 1812, vol. iii. p. 174, pl. 23.
Tetraodon stellatus,	*Stellated Globe-fish,*	FLEM. Brit. An. p. 174, sp. 31. Proceedings Zool. Soc. 1833, p. 115.
Tetrodon ,,	,, ,,	JENYNS, Brit. Vert. p. 489.

TETRODON. *Generic Characters.*—Both jaws are divided in the middle by a suture, producing the appearance of four teeth in front, two above and two below. The skin, over part of the body, armed with numerous short spines. The branchial orifice small.

IN this order of fishes, the *Plectognathi* of Cuvier's arrangement, the principal distinctive character consists in the maxillary bones being firmly attached to the intermaxillaries, and both united to the palatine arch.

Three examples of this singular-looking fish have been taken in this country, and all three in Cornwall. Pennant first described it as British from a specimen caught at Penzance. Mr. Donovan has recorded a second, taken on the Cornish coast, and mentions another obtained in the European seas. Still more recently a specimen was taken in Mount's Bay, a drawing of which was sent to the Zoological Society by Dr. Boase, and a notice of its occurrence appeared in the Proceedings for October 1833, as referred to.

In Ireland this fish has occurred once on the coast of Waterford.

Pennant called his fish *lævigatus* in the edition of his work published in 1776, and his editor adopted that of *lagocephalus* in the edition of 1812, referring to Linnæus and Bloch ; but the figure of the two specimens by Pennant and Mr. Donovan, and the drawing of the third sent to the Zoological Society by Dr. Boase, agree more closely with the figure of the Globe-fish in Grew's Rarities, tab. 7, and the *Orbis lagocephalus* of Willughby, plate I. 2, which appear to be intended to represent the same fish, and being without spots or stripes, are, I think, distinct from the *lagocephalus* of Linnæus and Bloch, the spots of which are referred to in the description of the one, and both spots and stripes shown in the coloured figure of the other.

Mr. Donovan, when calling this fish *stellatus*, appears not to have been aware that this term had been previously appropriated to an Indian species with black spots ; and still considering this fish provisionally as a new species, I propose for it now the name of our highly-esteemed British zoologist, by whom, as far as I am aware, it was first made known.

" The species of this genus are remarkable for being provided with the means of suddenly assuming a globular form by swallowing air, which, passing into the crop or first stomach, blows up the whole animal like a balloon. The abdominal region being thus rendered the lightest, the body turns over, the stomach being the uppermost part, and the fish floats upon its back, without having the power of directing itself during this state of forced distension. But it is while thus bloated and passive, at the mercy of the waves, that this animal is really most secure; for the numerous spines with which the surface of the body is universally beset are raised and erected by the stretching out of the skin, thus presenting an armed front to the enemy on whatever side he may venture to begin the attack."*

The following extract is derived from the very scientific and interesting narrative by Mr. Charles Darwin of the Surveying voyages of the Adventure and Beagle, vol. iii. page 13:—"One day I was amused by watching the habits of a Diodon, which was caught swimming near the shore. This fish is well known to possess the singular power of distending itself into a nearly spherical form. After having been taken out of water for a short time, and then again immersed in it, a considerable quantity both of water and air was absorbed by the mouth, and perhaps likewise by the branchial apertures. This process is effected by two methods; the air is swallowed, and is then forced into the cavity of the body, its return being prevented by a muscular contraction which is externally visible; but the water, I observed, entered in a stream through the mouth, which was wide open and motionless: this latter action must, therefore, depend on suction. The skin about the abdomen is much looser than that of the back; hence during the inflation, the lower surface becomes far more distended than the upper; and the fish, in consequence, floats with its back downwards. Cuvier doubts whether the Diodon, in this position, is able to swim; but not only can it thus move forward in a straight line, but likewise it can turn round to either side. This latter movement is effected solely by the aid of the pectoral fins, the tail being collapsed, and not used. From the body being buoyed up with so much air, the branchial openings were out of the water; but a stream drawn in by the mouth constantly flowed through them.

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* Dr. Roget. Bridgewater Treatise, vol. i. p. 433.

"The fish, having remained in this distended state for a short time, generally expelled the air and water with considerable force from the branchial apertures and mouth. It could emit, at will, a certain portion of the water; and it appears, therefore, probable that this fluid is taken in partly for the sake of regulating its specific gravity. This Diodon possessed several means of defence. It could give a severe bite, and could eject water from its mouth to some distance, at the same time it made a curious noise by the movement of its jaws. By the inflation of its body, the papillæ, with which the skin is covered, became erect and pointed. But the most curious circumstance was, that it emitted from the skin of its belly, when handled, a most beautiful carmine red and fibrous secretion, which stained ivory and paper in so permanent a manner, that the tint is retained with all its brightness to the present day. I am quite ignorant of the nature and use of this secretion."

The vignette is copied, on a very reduced scale, from one of the illustrations published in the Catalogue of the Museum of the Royal College of Surgeons in London, and is thus described:—"The figure in this plate is taken from the large specimen of Crop-fish, or Globe-fish (*Tetrodon Pennantii*, Yarrell). The abdominal parietes, and those of the œsophageal dilatation forming the air-bag, are laid open to show the smooth internal surface of the air-bag; the anterior opening into the first œsophagus, and the valvular passage to the second œsophagus."

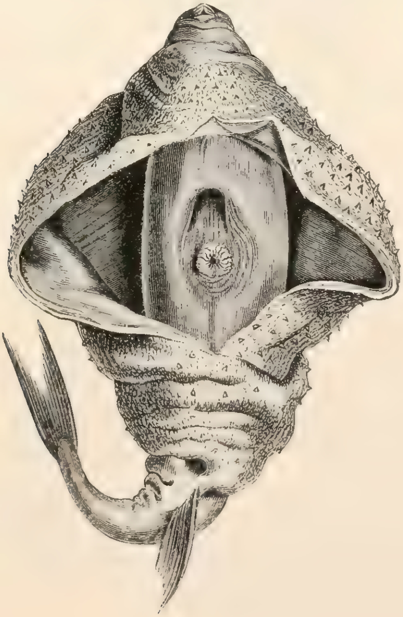
Pennant's fish measured one foot seven inches in length; the belly when distended, one foot; the whole circumference when in that state, two feet six inches. The form of the body is usually oblong; but when alarmed, it assumes the shape which has been already referred to. The mouth is small; the irides white, tinged with red; the back from head to tail almost straight, or at least very slightly elevated;

there are no ventral fins; the dorsal fin is placed low on the back; the anal fin is opposite; the tail almost even, divided by an angular projection in the middle.

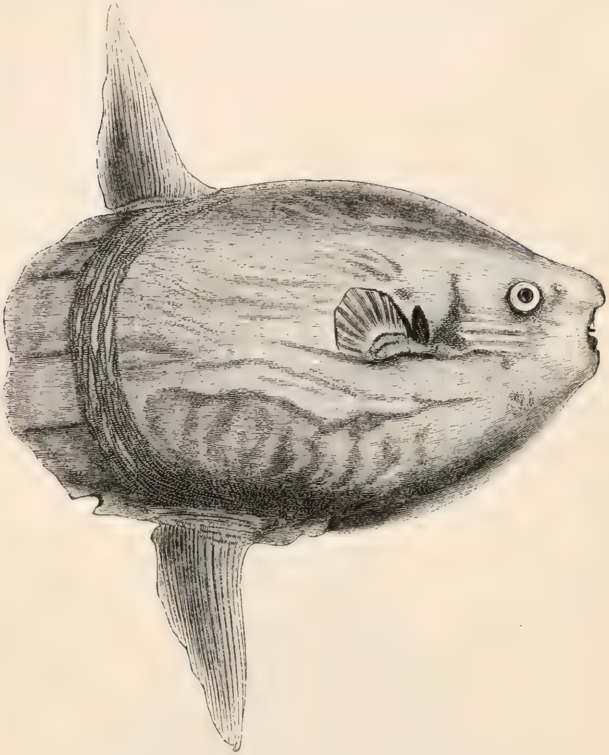
The number of fin-rays according to Mr. Donovan—

D. 11 : P. 14 : A. 10 : C. 6.

The back is of a rich blue colour; the belly and sides silvery white, studded over with straight spines arising from the centre of four rays; the fins and tail brown. The spines in Pennant's representation of this fish are not so thickly set as in the figure of Mr. Donovan, or in the drawing by Dr. Boase; but the space over which they are spread is alike in all three,—that is, bounded superiorly by the lower jaw and the base of the pectoral fin, and posteriorly by the anal aperture.



PLECTOGNATHI. *GYMNODONTIDÆ.*



THE SHORT SUN-FISH.

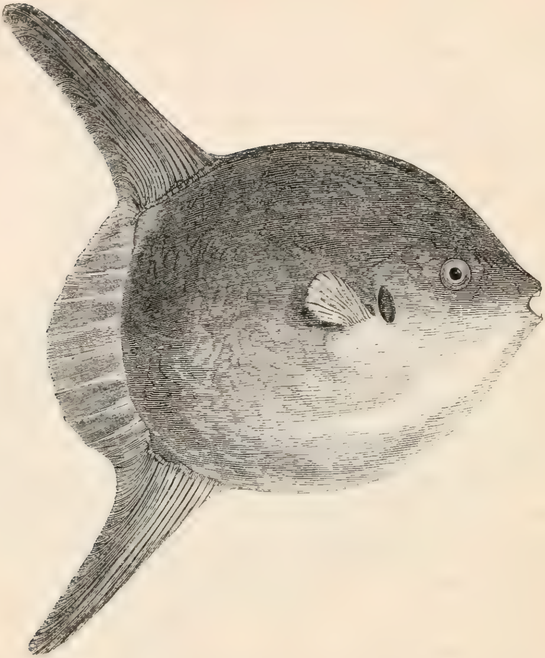
Orthagoriscus mola,	Schneider.	Cuvier, Règne An. t. ii. p. 369.
,, *Rondeletii,*	*Sunfish,*	Willughby, p. 151, I. 26.
Tetrodon mola,	*Short Tetrodon,*	Penn. Brit. Zool. vol. iii. p. 172, pl. 22.
,, ,,	*Sun-fish,*	Don. Brit. Fish. pl. 25.
Orthagoriscus mola,	*Molebut,*	Flem. Brit. An. p. 175, sp. 32.
,, ,,	,,	Jenyns, Man. Brit. Vert. p. 490, sp. 179.

Orthagoriscus. *Generic Characters.*—Jaws undivided, forming a cutting edge ; body compressed, deep for its length, short, truncated, without spines ; tail short, and very high vertically ; rays of the dorsal and anal fins long and pointed, both united to the caudal fin at the base.

The Sun-fish, as this species has been called from the twofold circumstance of its almost circular form and shining surface, though occurring but occasionally, may be said to have been taken from John o' Groat's to the Land's End.

Sir Andrew Balfour and Sir Robert Sibbald have noticed this species in Scotland, and Dr. Neill mentions three examples that were taken in the Frith of Forth. I am indebted to Edward Jesse, Esq. for a memorandum of one caught on the coast of Northumberland in October 1834. Dawson Turner, Esq. and Mr. Paget have known it to be taken at Yarmouth. I have seen one that was brought to the London market. Colonel Montagu, in his MS. notes, mentions one that was caught at Salcombe in July 1799: this specimen was of large size, and weighed three hundred pounds. In the fifth volume of Mr. Loudon's Magazine of Natural History, page 315, there is a record of one that was taken at Plymouth; and Dr. Borlase, Willughby, and Mr. Couch have seen and described examples that were taken on the Cornish coast. Still farther to the westward and northward, the Sun-fish has been taken in the Bristol Channel, and one was caught during last summer at Tenby. On the Irish coast, it has been taken at Londonderry; and I am greatly indebted to the kindness of Dr. Arthur Jacob, Professor of Anatomy in the Royal College of Surgeons in Dublin, for his remarks on a specimen taken in the month of August 1826, between the south-west coast of England and Dublin Bay. This paper was published in the Dublin Philosophical Journal for November 1826, and is the best account of this fish that I am acquainted with.

Since the publication of the previous edition of this work several other examples of this species have been taken on various parts of the coasts of the British islands. One at Shetland; another in the Forth, some of the anatomical peculiarities of which have been described by Mr. Goodsir, in the



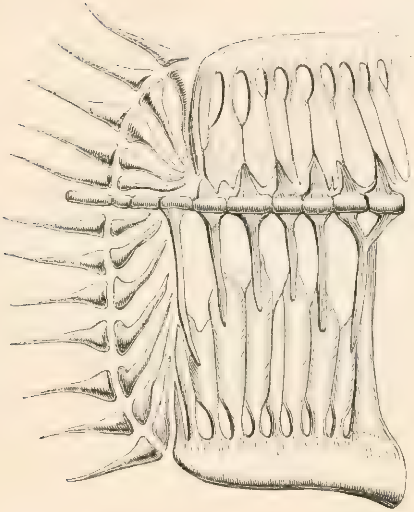
Edinburgh New Philosophical Journal for January 1841, with a representation of the hinder part of the skeleton, from which the figure here given, greatly reduced in size, was taken. Another specimen was washed ashore near Scarborough, and is now preserved in the museum there: this specimen weighed one hundred and twenty pounds. A specimen which weighed two hundred pounds was exhibited for several days in a fishmonger's shop in London in December 1840. The Rev. J. M. Colson sent me notice of one that was taken in Swanage Bay; and another was taken at the Isle of Purbeck. The Rev. Robert Holdsworth of Brixham has written to me of a small one, about eighteen inches long, that was caught off the Start Point. My friend Mr. George Mello sent me various particulars of a specimen taken in the autumn of 1839, about three miles from Ilfracombe. This example was estimated to weigh four hundred pounds. Mr. Dillwyn has recorded the capture of a Sun-fish, weighing about ninety pounds in Carmarthen Bay. Mr. M'Coy of Dublin sent me notice of the recent occurrence of this species on the coast of Ireland, and others are also recorded. Lastly, Dr. Storer includes this species of *Orthagoriscus* in his Catalogue of the Fishes of Massachusetts; one example had been secured near Boston, and others had been taken at no great distance.

When observed in our seas, they have generally appeared as though they were dead or dying, and floating along on one side, presenting the broad surface of the other side to view. Dr. Neill says, of one that was brought to him, "The fishermen informed him, that when they observed it, it was swimming along sideways, with its back-fin frequently above water. It seemed to be a stupid, dull fish: it made little or no attempt to escape, but allowed one of the sailors to put his hands under it, and lift it fairly into the boat. The Sun-fish has been generally mentioned as remarkable for its phosphorescence; but this specimen did not exhibit that phenomenon so distinctly as a Haddock or a Herring." Pennant repeats Brunnich's account, that between Antibes and Genoa he saw one of this species lie asleep on the surface of the water: a sailor jumped overboard and caught it.

Mr. Couch says the Short Sun-fish is migratory, keeping probably at the bottom, and feeding on seaweeds in its ordinary habits; but in calm weather it mounts to the surface, and lies, perhaps asleep, with its head and even its eyes above the water, floating with the tide. Mr. Couch has known the Sun-fish make powerful but awkward efforts to escape when attacked, bending and directing its motions in various ways.

The representation at the head of this subject is from an adult fish, the Scarborough specimen, which measured, from the point of the nose to the end of the caudal fin, three feet five inches ; depth of body alone one foot nine inches ; height of dorsal fin one foot five inches ; across the body, including dorsal and anal fins, four feet six inches : the weight one hundred and twenty pounds. The Ilfracombe specimen measured, from the point of the nose to the end of the caudal fin, five feet one inch ; depth of body alone three feet one inch ; height of dorsal fin one foot ten inches ; across the body, including dorsal and anal fins, six feet nine inches : weight as estimated four hundred pounds : from the point of the nose to the eye eleven inches ; diameter of the orbit two inches and a quarter : the irides greyish brown, with a bright straw-coloured ring near the pupil ; the pectoral fin is lodged in a depression ; the basal attachment of each fin is thick and fleshy. In these adult fish the skin is generally of a dingy greyish brown, the colour becoming lighter towards the belly ; the texture of the skin very hard, thick, and rough. These adult fish are also longer in the body, compared to their depth, than young fish ; the latter, without including the caudal fin, being almost round.

The second figure of this fish here given, and the description, are taken from a preserved specimen in the Museum of the Zoological Society. This is the smallest example I have seen. It measures but fourteen inches from the point of the nose to the end of the body ; the breadth of the caudal fin two inches ; the depth of the body eleven inches and a half : the length of the dorsal fin eight inches ; of the anal fin, seven inches and a half : the extension of skin connecting the fin-rays rather thick. The mouth small ; the branchial aperture just in advance of the pectoral fin, small and oval ; the vent just before the anal fin ; the caudal fin occupying the whole space between the anal and dorsal fins, and attached to the posterior vertical edge of the body as by a long hinge ; the surface of the body in this young specimen but slightly

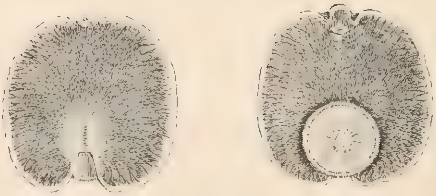


roughened, and somewhat wrinkled. The colour of the upper part of the body dusky bluish grey; the lower part olive brown. The fin-rays in number are—

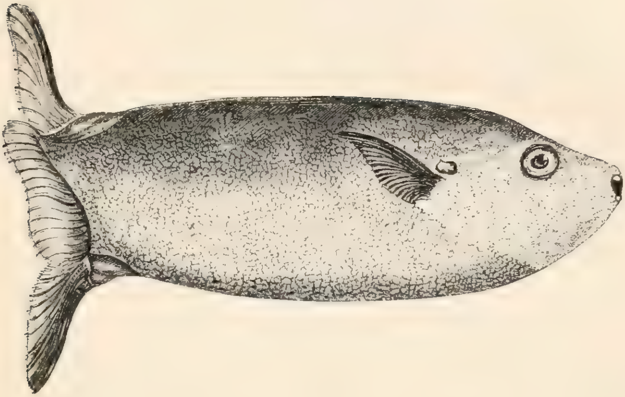
D. 15 : P. 11 : A. 15 : C. 13.

I am indebted to Mr. Couch for the under jaw-bone of a Sun-fish of considerable size. The outer margin of this bone, for three inches round the front, in which there is no division, is covered to its edge by a narrow band of enamel: the inside, near the centre, contains various dull pearl-like teeth; some thin and flat, presenting an edge: behind them others, more cylindrical, short, and rather pointed.

The Sun-fish is often infested with one or more species of parasites adhering to various parts of the body. Dr. Storer found one species attached to the branchiæ; the Ilfracombe fish had several attached to the soft parts about the anal aperture, and upon the external surface of the head of the example of the Sun-fish taken at Tenby, there were attached about twenty specimens of *Tristoma coccineum.* Two of these were given to me by H. E. Strickland, Esq. of Cracombe House, Gloucestershire, from one of which the representations in the vignette below of the upper and under surface were taken of the natural size. For an account of two species of these very rare parasitic animals, see the *Synopsis Entozoorum* of Rudolphi, page 427.



PLECTOGNATHI. *GYMNODONTIDÆ.*



THE OBLONG SUN-FISH.

Orthagoriscus oblongus,	Schneider.	Cuvier, Règne An. t. ii. p. 370.
Tetrodon truncatus,	*Oblong Tetrodon,*	Penn. Brit. Zool. vol. iii. p. 170, pl. 22.
,, ,,	*Truncated Sun-fish,*	Don. Brit. Fish. pl. 41.
Orthagoriscus truncatus,	,, ,,	Flem. Brit. An. p. 175, sp. 33.
,, *oblongus,*	*Oblong Sun-fish,*	Jenyns, Man. Brit. Vert. p. 491, sp. 180.

It has been the opinion of some naturalists that this Oblong Sun-fish is the same species as that last described, and that its greater length in proportion to its depth is but the consequence of greater age. One of the largest Short Sun-fish of which I have weight and measurement was that taken at Salcombe on the coast of Devonshire. It weighed three hundred pounds, was four feet five inches long, and six feet from the tip of the dorsal fin to the end of the anal fin. This was seen by Colonel Montagu, who was too keen an observer and too good a naturalist not to have detected the difference between the fish he examined and the described characters of the true *mola*, if any had existed; and this fish being probably very old, as well as very large, was the more likely to have assumed the elongated appearance of this second species.

The oblong Sun-fish seems to be much more rare than that last figured. Dr. Borlase appears to be the first and almost the only English writer who has seen and described it. In his Natural History of Cornwall, he speaks of it under the title of the Sun-fish from Mount's Bay, after having described and figured the Short Sun-fish, and mentions that a specimen of this second species was taken at Plymouth in 1734 that weighed five hundred pounds.

Mr. Donovan, in his Natural History of British Fishes, says, "We have seen the dried skin of this species, the animal of which, when living, weighed between two and three hundred pounds. Our figure is taken from a small specimen, obtained in a recent state, in one of our fishing excursions on the Bristol Channel. This fish subsists on worms of the testaceous and other tribes, small crabs, &c. fragments of these being found on dissection in the stomach."

Since the publication of the first edition of this work, a fish of this rare species wandered into the lock of the newly-made canal at a short distance west of Fowey, and was carefully skinned and preserved to be presented to the Royal Cornwall Museum. A description by Mr. Couch, published in the sixth volume of the Annals of Natural History, is as follows:—"The length twenty-two inches; depth of body over the side eleven inches and a half; from the snout to the eye two inches and three quarters; to the origin of the pectoral fin eight inches and a half; length of pectoral fin four inches and a half; width of caudal fin one inch and a half; dorsal and anal fins each about six inches long."

Never having seen a specimen of this fish, the figure here given is from Mr. Donovan's work, with part of the description of Pennant.

"This fish grows to a great bulk; that which was examined by Salvianus was above a hundred pounds in weight. In form it resembles a Bream, or some deep fish cut off in the middle. The mouth is very small, and contains two broad teeth, with sharp edges."

"The eyes are small; before each is a small semilunar aperture: the pectoral fins very small, and placed behind them. The dorsal fin and the anal fin are high, and situated at the extremity of the body; the tail fin is narrow, and fills all the abrupt space between those two fins."

"The colour of the back is dusky, and dappled; the belly silvery; between the eyes and the pectoral fins are certain streaks pointing downwards. The skin is free from scales."

"When boiled it has been observed to turn into a glutinous jelly, resembling boiled starch when cold, and served the purposes of glue, on being tried on paper or leather. The flesh of this fish is uncommonly rank: it feeds on shell-fish."

"There seems to be no satisfactory reason for the old English name. Care must be taken not to confound it with the Sun-fish of the Irish,* which differs in all respects from this."

Dr. Turton describes the body of the Oblong Sun-fish to be nearly thrice as long as it is deep: the aperture of the gills semilunar. The fin-rays in number, according to Mr. Donovan, are—

D. 12 : P. 14 : A. 15 : C. 17.

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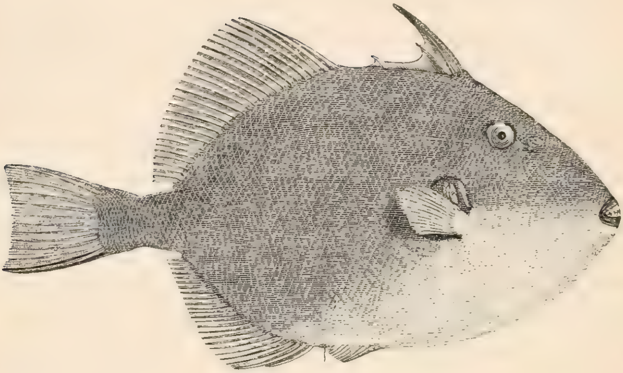
* The Sun-fish of the Irish coast, particularly on the west coast of Ireland, is the Basking Shark, to be hereafter described, which sometimes attains a length of thirty feet, and is so called from its habit of basking and sunning itself at the surface of the water.

PLECTOGNATHI. *BALISTIDÆ.*[*]



THE EUROPEAN FILE-FISH.

Balistes capriscus,	Cuvier, Règne An. t. ii. p. 372.	
Capriscus Rondeletii,	*Pesce Balestra,*	Willughby, p. 152, I. 19.
Balistes maculatus,	*File-fish,*	Bloch, pt. v. pl. 151 ?
,, *capriscus,*	*Mediterranean File-fish,*	Jenyns, Brit. Vert. p. 492.

Balistes. *Generic Characters.*—Body compressed, covered with hard rhomboidal imbedded plates, which are not imbricated like scales; two dorsal fins, the first containing spines only, the second long; mouth with incisor-like cutting teeth in each jaw.

The only example of this genus which has occurred in the English seas, that I am aware of, was taken off the Sussex coast in the month of August 1827; and the circumstance was made known by J. G. Children, Esq. who obtained the specimen, and who recorded this interesting capture in his address delivered at the anniversary meeting of the Zoological Club of the Linnean Society on the 29th of November of the same year. The specimen was exhibited.

This fish has since been deposited in the national collection at the British Museum; and by the kindness of the officers of the natural history department of that establishment, I have been permitted to take a drawing and description from the specimen caught in our seas.

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[*] The family of the File-fishes.

The *Balistes capriscus* is a species well known to the older authors as an inhabitant of the Mediterranean; is figured by Salvianus; by Grew, in his Rarities, tab. 7; and by Klein, tab. 3. It is, however, rather rare, though stated also to be an inhabitant of other seas. M. Risso says the flesh is tolerably good.

Baron Cuvier, in the *Règne Animal*, in part of the first note at the foot of page 372, says in reference to *Balistes capriscus*, "Je suis même tenté d'y rapporter le *B. buniva* de Lacépède." Possessing a dried specimen of *B. buniva* from the Mediterranean, which agrees exactly with the published descriptions of that species by Lacépède and M. Risso, I have compared it with the specimen of *B. capriscus* at the British Museum, and feel confident that the *B. buniva* of Lacépède is, as Cuvier suspected, identical with the *B. capriscus* of authors.

The first and strongest spine of the back in this fish is studded up the front with numerous small projections, which under the microscope have the appearance of so many points of enamel or pearl arising from the surface of the bone, giving a rough denticulated appearance; and hence the name of File-fish. The second smaller spine has at the anterior part of the base a projection which, when the spines are elevated, locks into a corresponding depression in the posterior part of the base of the first spine, and fixes it like part of the work in a gun-lock; and from this similarity this fish on the Italian shores of the Mediterranean is called *Pesce balestra.* The longest spine cannot be forced down till the shorter spine has been first depressed.

The length from the nose to the branchial orifice is to the whole length of the fish as one to four; the depth of the body is rather less than half the whole length of the fish, the tail included in both measurements: the body compressed; the surface hard; the scales arranged in oblique lines over the whole breadth; no lateral line observable, except along the middle of the fleshy portion of the tail: the mouth small and narrow; the visible teeth four on each side the centre above and below, incisor-like or cutting; the forehead wide between the eyes, which are small, enclosed in well-defined orbits; the branchial orifice an elongated aperture commencing in the front at the base of the pectoral fin, and ascending obliquely backward; pectoral fin of small size: first spine of the first dorsal fin in a vertical line over the branchial orifice, the second close behind and attached by a strong ligament; the third spine removed to a distance, but connected by a membrane: the second dorsal fin is high anteriorly and long, commencing in a vertical line before the commencement of the anal fin, but both ending on the same plane, and far short of the base of the caudal rays; in advance of the anal fin is a strong rough keel, which has some resemblance to ventral fins: the fleshy portion of the tail free, and rather long; the rays nearly square at the end, large and strong.

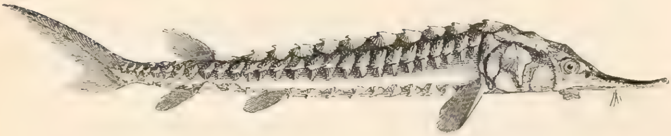
The fin-rays in number are—

D. 3. 28 : P. 15 : A. 26 : C. 14.

The colour in the dried specimen is nearly a uniform pale brown; rather darker on the back; becoming lighter on the belly, and particularly on the under surface of the head: the naked gums smooth and dark brown. Living specimens are said to be tinged and even spotted with blue; and it is probable that an individual in this state has furnished the material on which *B. maculatus* of Bloch is founded: the irides are described as green.

The whole length of the Museum specimen is nine inches and a half; the depth four inches and three-eighths without the dorsal or anal fins.

CHONDROPTERYGII. *STURIONIDÆ.*[*]



THE COMMON STURGEON.

Acipenser Sturio,	*Common Sturgeon,*	Linnæus. Bloch, pt. iii. pl. 88.
Sturio,	*The Sturgeon,*	Willughby, p. 239, P. 7, fig. 3.
Acipenser Sturio,	*Common Sturgeon,*	Penn. Brit. Zool. vol. iii. p. 164, pl. 22.
,, ,,	*L'Esturgeon,*	Cuvier, Règne An. t. ii. p. 379.
,, ,,	*Common Sturgeon,*	Don. Brit. Fish. pl. 65.
,, ,,	*Sturgeon,*	Flem. Brit. An. p. 173, sp. 30.
,, ,,	*Common Sturgeon,*	Jenyns, Man. Brit. Vert. p. 493, sp. 182.

Acipenser. *Generic Characters.*—Body elongated and angular, defended by indurated plates and spines, arranged in longitudinal rows; snout pointed, conical; mouth placed on the under surface of the head, tubular, and without teeth.

All the remaining portion of the British Fishes to be yet described belong to Cuvier's division called *Chondropterygiens*, or Cartilaginous Fishes, the skeletons of which are made up of cartilage, and not, as in the divisions of *Acanthopterygiens* and *Malacopterygiens*, made up of true bone. The earthy matter in the hard parts of these fishes is smaller in quantity, is deposited in grains, and does not assume the form, as in other fishes, of distinct osseous fibres.

In the fishes of the families contained in this order there are several interesting peculiarities. Some have their gills free, like those of ordinary fishes; there are others in which the gills are fixed by having their outer edges attached to the skin. Several of them bring forth their young alive in a manner very different from any of the true bony fishes; while some, and these the last in the series, want that degree of organization in the bones of the upper jaw observable in those generally which have been hitherto described, but of which two or three examples of deficiency by malformation have been figured.

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[*] The family of the Sturgeons.

This order may be said to be further distinguished by including within its limits fishes exhibiting in certain points of their structure the highest as well as the lowest degrees of organization observable throughout the whole class. These different peculiarities will be pointed out on arriving at the different genera in succession.

The Sturgeon, the first of the cartilaginous fishes, allied to the Sharks in the elongated form of its body, resembles other fishes in having the gills free, and in being oviparous. It is caught occasionally on various parts of our coast, most frequently in the estuaries, or but a short distance up rivers; very seldom taken in the open sea, where it is believed to inhabit deep water, beyond the reach of nets, and is not, that I am aware, ever caught upon the fishermen's lines. Dr. Neill says that one or two are generally taken every summer about the mouth of the Almond or of the Esk, where they get entangled in the Salmon nets, and when of large size frequently doing the fishermen considerable damage by tearing their nets. They are otherwise harmless. One caught in a stake net near Findhorn in Scotland in July 1833, measured eight feet six inches in length, and weighed two hundred and three pounds.

The Sturgeon is occasionally taken on the East coast, and frequently brought to the London market from various localities. When caught in the Thames, within the jurisdiction of the Lord Mayor, it is considered a Royal Fish; the term being intended to imply that it ought to be sent to the King, and it is said that the Sturgeon was exclusively reserved for the table of Henry the First of England.

On our southern coast, Colonel Montagu mentions one taken in the estuary at Kingsbridge; and Mr. Couch enumerates three instances at different periods of different years; one in the Tamar in June, one at Plymouth in August, and one near the Eddystone in January. In September 1802, a specimen, eight feet long, and weighing one hundred and ninety-two pounds, was caught in a weir below the castle at Shrewsbury. The largest specimen taken in this country is probably the fish recorded by Pennant, which was caught in the Esk, and weighed four hundred and sixty pounds.

In Ireland the Sturgeon has been taken on the south, the east, and the north coasts.

In the northern parts of Europe this fish is much more numerous than with us, and extensive fisheries are established for its destruction. Caviare is made of the roe of the female; isinglass is obtained from the dense membrane forming the air-bladder; and the flesh, besides being preserved by salting and pickling, is in request for the table while fresh, being generally stewed with rich gravy, and the flavour considered to be like that of veal. The flesh, like that of most of the cartilaginous fishes, is more firm and compact than is usual among those of the osseous families.

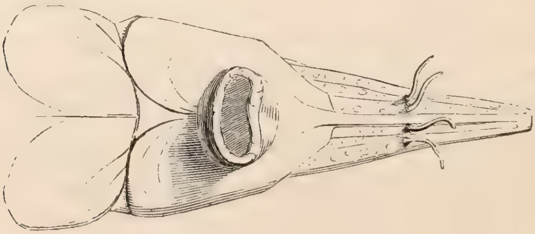
The Sturgeon, as has been before observed, is oviparous, spawning in winter. It has been frequently remarked that Sturgeons of very small size are seldom seen: by the kindness of Mr. George Daniell, however, I possess a small specimen, only twelve inches long, that is quite perfect, and exhibits all the characters of the mature fish. "It is presumed that the young, as soon as they escape from the eggs, which the female deposits in fresh water, descend immediately to the sea, and do not visit the places of their birth again till they come in their turn to deposit their spawn." The Sturgeon is said to subsist on small fishes ; from the structure of the mouth it probably feeds also on any soft substance that it finds at the bottom.

The body is elongated; from the shoulders backward somewhat pentagonal in shape, with five longitudinal rows of flattened plates, having pointed central spines directed backwards,—one row, larger than the others, along the ridge of the back, one row on each side, and another along the edge of the abdomen in a line from the pectoral fin to the ventral on each side ; the flattened plates are marked with radiating striæ. The nose is long and pointed ; the forehead with a longitudinal depression ; the crown of the head elevated, the occiput rising into a sharp keel : the mouth placed on the under surface of the head, rather wider than long, with a projecting rim ; no teeth within : about half-way between the mouth and the end of the nose, are four cirri ranged in a line across ; the eyes small ; the operculum hard and strong, covered with striæ radiating from a centre ; dorsal fin placed very far back, but little in advance of the line of the anal fin : tail forked ; upper lobe much the longest, and pointed. The fin-rays in number—

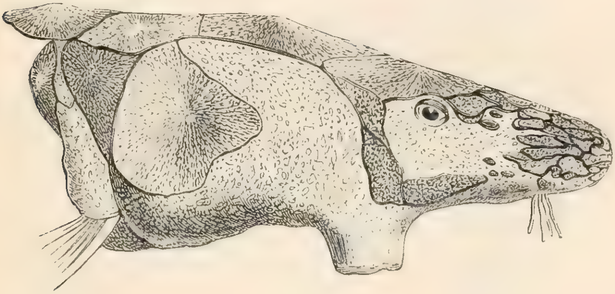
D. 35 : P. 28 : V. 24 : A. 23 : C. 125.

The colours of the body are various shades of brown ; the plates nearly white, the belly silvery.

The vignette represents the under surface of the head ; and two other representations of the head are given with the next species for comparison.



CHONDROPTERYGII. *STURIONIDÆ.*



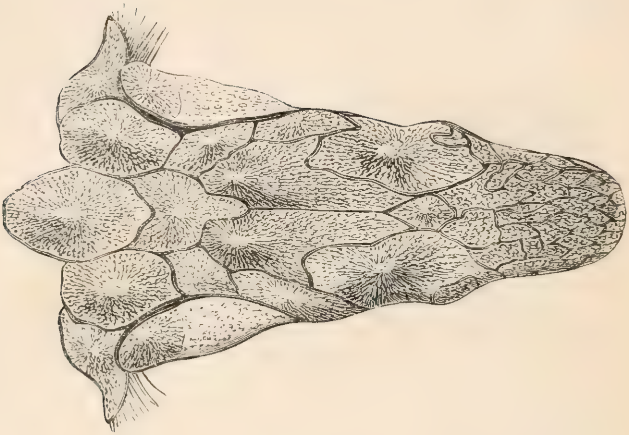
THE BROAD-NOSED STURGEON.

Acipenser latirostris, Broad-nosed Sturgeon, PARNELL, Trans. R. S. E. vol. xiv. pl. 4.
,, ,, ,, ,, PARNELL, Fish. of the Forth, Wern. Mem. vol. vii. p. 405, pl. 39.

IN the papers here referred to, Dr. Parnell observes, that but one species of Sturgeon has hitherto been recorded by the different writers on British Ichthyology, but from the observations of practical fishermen, as well as his own, Dr. Parnell adds, "I think there is little doubt that two species, at least, will in future be recognized as inhabiting the British coast.

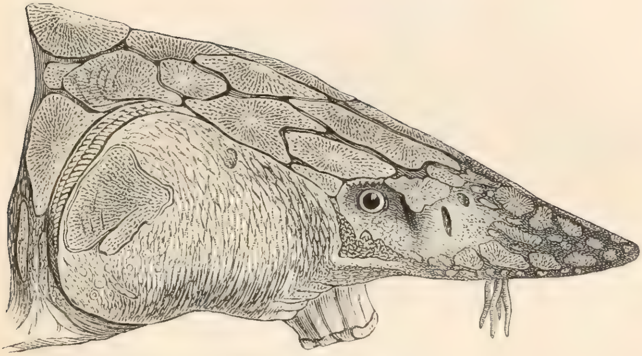
"It has long been noticed by the fishermen of the Solway Frith, that two species of Sturgeon are occasionally entangled in their Salmon-nets, the one with a blunt nose, and the other with a sharp one; the latter species being the most common of the two.

"A fine specimen of the Blunt-nosed Sturgeon was taken in the Frith of Forth in the month of July 1835, and



brought to the Edinburgh market for sale, the head of which I preserved. A few weeks after another was taken in the Tay, which differed in no respect from the former, except in sexual distinction."

" Length seven feet nine inches; weight eight stone, or one hundred and twelve pounds. The colour of the back and sides is of a light grey, with a shade of olive; the belly dirty white. The body is armed with five rows of osseous shields, running from the head to the tail. The first row commences behind the head, and runs down the central ridge of the back; the two next rows arise one on each side of the former. Immediately on the lower margin of the pectorals the other two rows commence. The skin is rough, with a number of small angular osseous plates intermixed with very minute spicula. The first free shield on the dorsal ridge is nearly circular, and very slightly carinated; all the rest in that row are of an oval form. The snout is wide and depressed, much broader than the diameter of the mouth. On the under surface, placed nearer to the tip of the snout



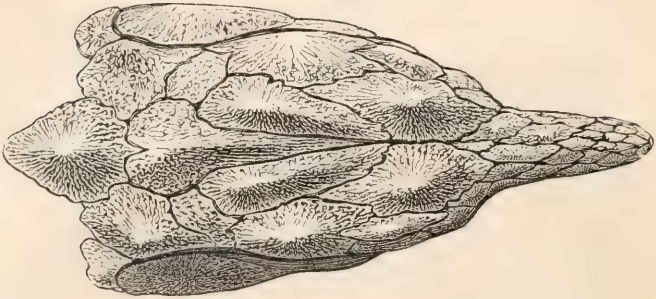
than to the mouth, are four cirri arranged in an irregular line. The summit of the head is rough, with the central plates beautifully radiated, and of a fibrous appearance. The position of the fins is the same as in other Sturgeons."

" This fish differs from the Common Sturgeon, *Acipenser sturio*, in having the tip of the snout much broader than the mouth, in the keel of the dorsal plates being but slightly elevated, and having the cirri placed nearer to the tip of the snout than to the mouth."

" The Sturgeons are all much allied to each other; and not being able as yet to find the right synonym for the present one, I have proposed, in the mean time, the name *latirostris*, as characteristic of the species."

" In the stomach of the one from the Tay was found an entire specimen of the Sea-mouse, *Aphrodita aculeata*."

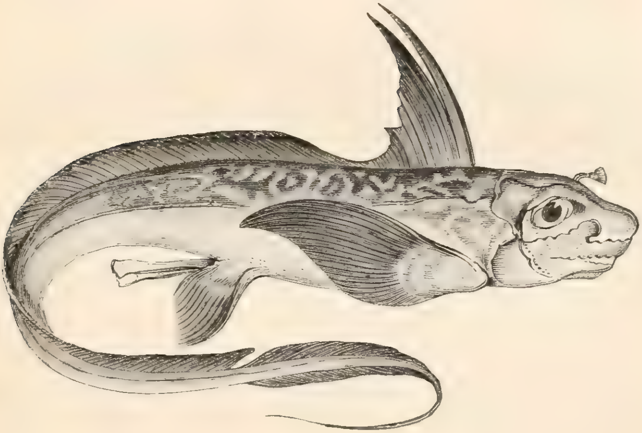
Dr. Parnell has presented the preserved head of this specimen to the Museum of the Zoological Society; but, like Dr. Parnell, I have been unable to identify it with any described Sturgeon. It does not agree with either of the nine



species found in the various waters of the Russian empire, figured and briefly described by M. A. Lovetski, in the third volume of the Transactions of the Imperial Society of Naturalists at Moscow; nor am I able to say that it agrees with either of the eleven species figured and described by Messrs. Brandt and Ratzburg in their Medical Zoology.

Baron Cuvier has observed in his *Règne Animal*, t. ii. p. 379, note, that the species of this genus are not yet well determined by naturalists, nor their comparative characters sufficiently defined. Supposing that the bony plates of the head, by their form, size, and relative situation, might afford specific characters, I have given two views of these parts in our two British Sturgeons, not without some suspicion, like Dr. Parnell, that we may have even more than two.

CHONDROPTERYGII. *CHIMÆRIDÆ.*



NORTHERN CHIMÆRA.

KING OF THE HERRINGS. RABBIT-FISH, *Zetland.*

Chimæra	*monstrosa,*	Linnæus.	Bloch, pt. iv. pl. 124.
,,	,,	*Northern Chimæra,*	Penn. Brit. Zool. vol. iii. p. 159.
,,	,,	*Sea Monster,*	Don. Brit. Fish. pl. 111.
,,	,,	*Rabbit-fish,*	Flem. Brit. An. p. 172, sp. 29.
,,	,,	*Sea-Monster,*	Jenyns, Brit. Vert. p. 494.

Chimæra. *Generic Characters.* — Body elongated, the tail ending in a lengthened filament; the first dorsal fin short at its base, but high; the second dorsal fin low, commencing immediately behind the first, and extending to the tail.

This fish has considerable resemblance to the Sharks in the form of the body, and the position as well as the shape of the fins.

“ The Chimæræ,” says Dr. Richardson,* “ though placed by Cuvier at the end of the *Sturionidæ*, seem to belong more properly to his second order of *Chondropterygii*, in which the gills are fixed: for though there is only one apparent gill-opening on each side, the gills in reality adhere by a large part of their borders, and there are consequently five holes communicating with the external gill-opening. They have a rudimentary operculum concealed by the skin; and their jaws, still more reduced than those of the Sharks, are furnished with hard plates, four above and two below, in place of teeth. The males are distinguished by trifid bony appendages to the ventral fins, and produce very large leathery eggs, having flat velvety edges." The first figure here given is that of a male; the second that of a female.

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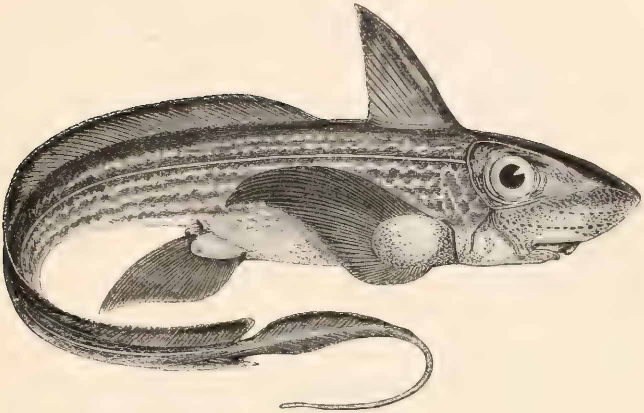
* Fauna Boreali-Americana, pt. iii. Fishes, page 285.

The Northern Chimæra is represented as a fish of singular appearance and beauty, a native of the northern seas principally, where it seldom exceeds three feet in length, and is generally taken when in pursuit of shoals of Herrings, or other small roving fishes, upon which it principally subsists: Bloch says it feeds also on medusæ and crustacea. The flesh is described as hard and coarse. According to some authors, the Norwegians extract an oil from the liver which they consider of singular efficacy in disorders of the eyes.

Pennant received from a gentleman a drawing and particulars of one that had been taken among the Shetland Islands: this species was also known to Dr. Walker as an occasional visiter in that locality. Never having seen this fish, I avail myself of Dr. Fleming's description, taken from a specimen sent by L. Edmonston, Esq. from Unst, where it is termed the Rabbit-fish. A specimen taken from the same locality has lately been received by Mr. W. C. Hewitson of Newcastle, the author of a valuable work on the eggs of British Birds.

"Length nearly three feet. Body compressed. Head blunt; the snout sub-ascending, blunt. A narrow crenulated grinder on each side in the lower jaw, and a broad tubercular

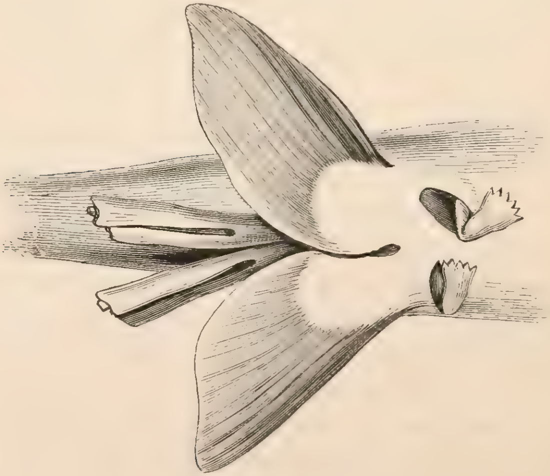


one corresponding above. Nostrils immediately above the upper lip contiguous, each with a cartilaginous complicated valve. Branchial openings in front of the pectorals. Eyes large, lateral. On the crown, in front of the eyes, a thin osseous plate, bent forwards, with a spinous disc at the extremity on the lower side. Lateral line connected with numerous waved anastomosing grooves on the cheeks and face. The first dorsal fin above the pectorals narrow, with a strong spine along the anterior edge. The second dorsal rises immediately behind the first, is narrow, and is continued to the caudal one, where it terminates suddenly. The pectorals are large, and subtriangular. Ventrals rounded; in front of each a broad recurved osseous plate, with recurved spines on the ventral edge. Claspers pedunculated, divided into three linear segments; the anteal one simple, the retral ones having the opposite edges covered with numerous small reflected spines. A small anal fin opposite the extremity of the second dorsal. Caudal fin above and below, broadest near the origin, gradually decreasing to a linear produced thread."

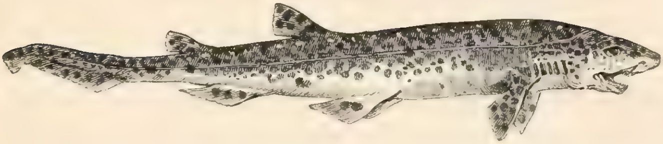
The appendage on the front of the head in this fish is peculiar to the males only, and has given rise to the name of King-fish, applied to it by the Norwegians; who also call it Gold and Silver Fish, in reference to its beautiful colours: these are various shades of rich brown on a shining white ground. The eyes are large and brilliant; the pupils green, the irides white.

This fish was first made known by Gesner.

The first representation here given is that of a male fish, and was taken from one of two views of this fish forming the subjects of the fifth and sixth plates in the second volume of Natural History Memoirs of Drontheim. The second figure is that of a female, and is derived from the *Fauna Italica* of C. L. Bonaparte, Prince of Canino: this species is therefore found in the Mediterranean. The final vignette, also from the Memoirs of Drontheim, represents the abdominal osseous plates with their spines, the under surface of the ventral fins, and the pedunculated claspers peculiar to the males.



CHONDROPTERYGII. *SQUALIDÆ.**



THE SMALL-SPOTTED DOG-FISH.

MORGAY, *Scotland.*—ROBIN HUSS, *Sussex coast.*

Scyllium canicula,	*La Grand Roussette,*	Cuvier, Règne An. t. ii. p. 386.
,, *catulus,*	*Morgay,*	Flem. Brit. An. p. 165, sp. 8.
,, *canicula,*	*Spotted Dog-fish,*	Jenyns, Man. Brit. Vert. p. 495, sp. 184.
Squalus canicula,	Linnæus.	Bloch, pt. iv. pl. 114.
,, ,,	*Spotted Shark,*	Penn. Brit. Zool. vol. iii. pl. 19. Upper fig. male; lower fig. female.
,, *catulus,*	*Lesser Spotted Shark,*	
,, ,,	,, ,, ,,	Don. Brit. Fish. pl. 55.
,, *canicula,*	Nils. Prod. Ichth. Scand. p. 113.	
Scylliorhinus catulus,	*Le Squale Roussette,*	Blainville, Faun. Franç. p. 69.
Scyllium canicula,	Bonap. Faun. Ital. fasc. vii.	

Scyllium. *Generic Characters.*—An anal and two dorsal fins; the first dorsal fin placed behind or opposite, but never before, the abdominal fins. Head short and blunt; nostrils pierced near the mouth, and continued by a fissure in the upper lip, forming valves. Teeth small, triangular, pointed, with one or more lateral denticles at the base on each side. Eyelids wanting. Spiracles distinct. Branchial openings five, partly over the pectoral fins.

The true Sharks, as previously stated, have their gills fixed, their margins being attached; the water escaping by five elongated branchial apertures, the form and position of which, in conjunction with modifications observed in the fins and other parts, furnish characters by which the different divisions forming this family are distinguished. Among the Sharks, the males differ from the females externally in having an elongated cylindrical appendage at the inner edge of each ventral fin, the uses of which are not understood. The third species of Shark here figured represents a male fish, and shows the peculiarity of the ventral fins in that sex. The females are not furnished with these appendages: the figures of the first two species represent females, and the vignettes to each show on an enlarged scale the specific and sexual peculiarities of the ventral fins, and also the difference in the form of the mouth in these two species.

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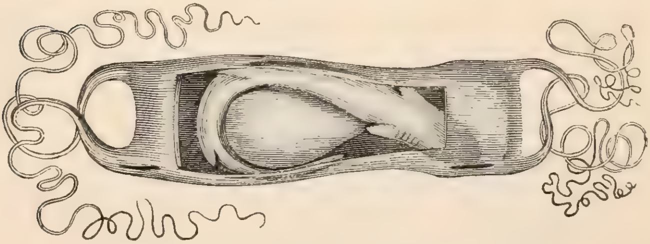
* The family of the Sharks.

Of the true Sharks, some produce their young alive, and are called viviparous; others, like those under present consideration, bring forth their young enclosed in horny cases, an example of which is here introduced, a portion of one side of the case being removed to show the young fish within.



On examining adult females, the ova are observed in different stages of growth descending from the ovaries, usually in pairs, frequently one in each oviduct, becoming enclosed in the protecting covering when about to be excluded. These cases, which are frequently found on the sea-shore, and are called Mermaid's purses, sailor's purses, sea purses, &c. are oblong, of a pale yellowish horny colour, semitransparent, with an elongated tendril at each of the four corners: these are deposited by the parent Shark near the shore in the winter months. The convoluted tendrils hanging to sea-weed or other fixed bodies prevent the cases being washed away into deep water. Two elongated fissures, one at each end, allow the admission of sea-water; and the young fish ultimately escapes by an opening at the square end, near which the head is situated. For a short time the young Shark continues to be nourished by the vitelline fluid contained in the capsule attached to its body by the connecting pedicle, till, having acquired the power of taking food by the mouth, the remains of the ovum are taken up within the abdomen, as in birds and some other animals.

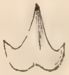
A curious peculiarity has been observed in the young of both Sharks and Skate during a very early stage of their existence. From each of the branchial apertures, branchial filaments project externally; each filament contains a single minute reflected vessel, in which the blood is thus submitted to the action of the surrounding medium. These appendages are only temporary, and the blood of the fish is afterwards aerated by the true gills. This very interesting discovery, which I believe is of recent date, forcibly reminding us of the temporary external branchiæ in the young of Batrachian reptiles in the tadpole state, has been observed by Mr. Richard Owen in the Blue Shark, *Carcharius glaucus*, by Dr. John Davy in the Torpedo, and by Dr. Allen Thompson of Edinburgh in the Thornback. Cuvier had previously noticed it, and in the *Règne Animal* has referred to a figure published by Schneider of a very young Shark in this condition, for which, regarding it as the normal state of this fish, that industrious pupil of Bloch had proposed the name of *Squalus ciliaris*.

Among the Sharks, as among the truly predacious birds, the females are larger than the males; and almost all the species have received some name resembling Beagle, Hound, Rough Hound, Smooth Hound, Dog-fish, Spotted Dog, Penny Dog, &c. probably from their habit of following their prey or hunting in company or packs. All the Sharks are exceedingly tenacious of life. Their skins, of very variable degrees of roughness, according to the species, are used for different purposes; in some instances by cabinet makers, for bringing up and smoothing the surfaces of hard wood.

The two British species of Spotted Sharks appear to have been frequently confounded with each other. The terms Greater and Lesser seem sometimes to have been considered as referring to the size of the spots, and at others to the size of the fish. A slight alteration in the names, which is here suggested, will assist in defining the two species, and other decided specific distinctions will be pointed out. Both species are called ***Roussette*** by the French, on account of their prevailing reddish brown colour.

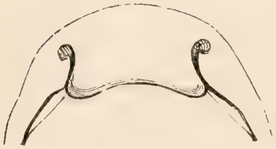
The Small-spotted Dog-fish, the subject of the present notice, is one of the most common species on our shores, particularly along the southern coast. Its station in the water is near the bottom; its food, small fish and crustacea. It takes a bait freely, and is often caught on the fishermen's lines, but is a useless capture to them. It is troublesome and annoying from its numbers, and injurious to the fisheries from its voracity.

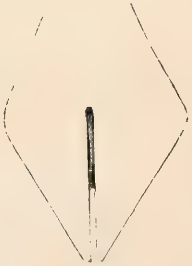
The teeth of the Sharks are very formidable weapons, generally constructed decidedly either for cutting or holding. The teeth of the Shark now under consideration is of the form here shown. The outside tooth in the front row of each jaw



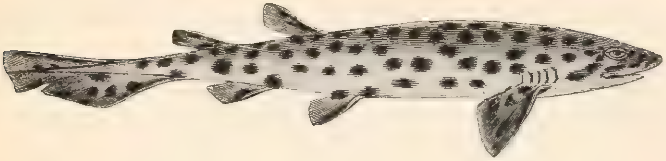
is supported on the inside by various other teeth, which supply deficiencies as necessity may require.

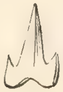
The specimen from which the description was taken measured eighteen inches in length; the body, from the base of the pectoral fins, where it is thickest, tapering all the way to the end of the tail. The head is flattened on the top; the eyes large; the orbits elongated, with a distinct aperture (a spiracle) behind each; the form of the under surface of the nose, the nostrils, and upper lip, as shown in the left-hand figure of the vignette at the end; the mouth shaped like a horse-shoe, the extreme angles only being directed outwards; the teeth numerous, small, pointed, and sharp; the pectoral fins large: the branchial apertures on the sides of the neck elongated vertically, five in number, the first rather the largest, the last the smallest; the fourth aperture over the anterior edge of the pectoral fin: the ventral fins united almost to the posterior extremity in the males, less completely united in females; the elongated anal aperture in the middle between them: the outer posterior margins, in both sexes, are as oblique as those of the front: the right-hand figure of the vignette at the end shows the lozenge-shape of the fins when seen from below. The first dorsal fin is over the space between the ventral and anal fins, and occupies nearly the middle of the whole length of the fish; the anal fin is under the space between the first and second dorsal fins; the posterior edge of the second dorsal fin half-way between the commencement of the first dorsal fin and the end of the tail; the vertebral portion of the tail nearly in a line with the body, with a narrow elongated membranous expansion above it, and one long and one short triangular expansion below it. All the upper part of the body marked with numerous small, dark, reddish brown spots, on a pale reddish ground; the spots on the fins rather larger and less numerous than those on the body; the lower part of the sides and the under surface yellowish white. The skin, to the finger passed from the head towards the tail, is smooth; in the opposite direction it is rough. The appearance of the skin under a lens is that of being covered with minute spiculæ, all the points of which are directed backwards.





CHONDROPTERYGII. *SQUALIDÆ.*





THE LARGE-SPOTTED DOG-FISH.

BOUNCE, *Scotland and Devonshire.*

ROCK DOG-FISH.

Scyllium catulus, La Petite Roussette,	Cuvier, Règne An. t. ii. p. 386.
,, *stellaris, Le Rochier,*	,, ,, ,, ,,
,, *stellare, Bounce,*	Flem. Brit. An. p. 165, sp. 7.
,, *stellaris, Rock Dog-fish,*	Jenyns, Man. Brit. Vert. p. 496, sp. 185.
Squalus catulus et stellaris,	Linnæus.
Scylliorhinus stellaris, Le Squale Rochier,	Blainville, Faun. Franç. p. 71.
Scyllium stellare,	Bonap. Faun. Ital. fasc. vii.

This Shark is at once distinguished from the species last described by its larger but less numerous spots, and by the ventral fins, which are truncated or nearly square at the end. Like the Small-spotted Dog-fish, its haunts are near the bottom, and its food similar; but it also frequents rocky ground, and has accordingly been distinguished on the Continent by the term *Rochier*, as shown in the list of synonymes.

Mr. Jenyns, in his valuable Manual of British Vertebrate Animals, has so clearly pointed out the specific distinctions of this fish, from examples obtained at Weymouth, that, having no specimen, this Shark being by much the more rare of the two, I avail myself, by permission, of the comparative description therein given.

"Length from two to three feet. According to M. Blainville, this species attains to a larger size than the last. Differs essentially from *S. canicula* in the structure of the lobes of the nostrils, and in the form of the ventrals:[*] the former are not united as in that species, and of a smaller size, leaving the whole of the mouth and the upper lip visible: the ventrals, instead of being cut obliquely, are cut nearly square, their posterior margins meeting at a very obtuse angle; they are united or separate according to the sex, in a similar manner; the snout is rather more elongated; and, according to some authors, the tail rather shorter, giving the dorsal a more backward position; but this last character I have not noticed myself. Upper parts brownish grey, with very little of the red tinge observable in the last species: back, flanks, and tail, sparingly marked with large spots of a deep brown or black colour: under parts whitish."

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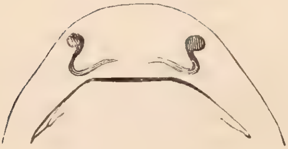
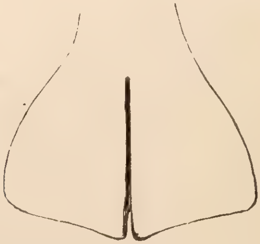
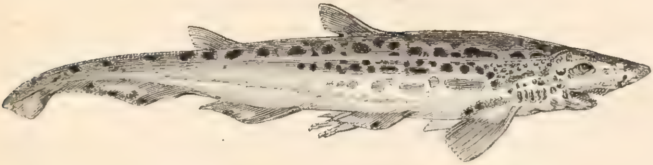
[*] See the vignettes of the nostrils and the ventral fins of both species.





CHONDROPTERYGII. *SQUALIDÆ.*



THE BLACK-MOUTHED DOG-FISH.

EYED DOG-FISH, *Cornwall.*

Squalus annulatus,	Nils. Prod. Ichth. Scand. p. 114, sp. 2.
Scyllium melanostomum,	*Eyed Dog Fish,* Couch, MS.
Scylliorhinus Delarochianus,	Blainv. Faun. Franç. p. 74.
,, *melanostomus,*	,, ,, ,, p. 75.
Scyllium melanostomum,	Bonap. Faun. Ital. fasc. vii.
Pristiurus melanostomus,	Müller & Henle Plag. p. 15.

Pristiurus. *Generic Characters.*—Differ from *Scyllium* only in having a longer snout, and a series of larger scales arranged like the teeth of a saw on the upper edge of the tail.

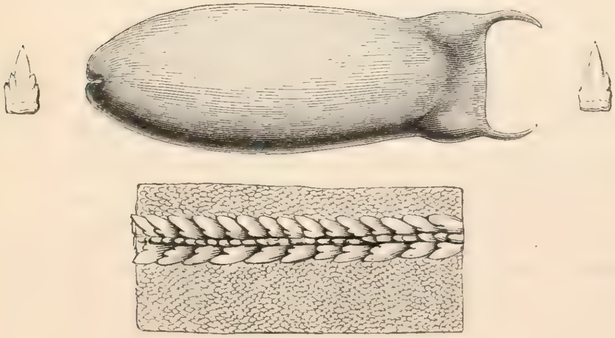
At the time of publishing the account of this Shark in the first edition of the British Fishes, I was only aware of the single example obtained by Mr. Couch. Since then I have ascertained from the communications of John Malcolm, Esq. that this species is not uncommon on the west coast of Scotland; and Mr. Malcolm, very kindly, gave me one of two specimens that had been procured and sent to him from that locality. It has also been taken in the North of Ireland by Captain Portlock, to whom I am indebted for sketches from which the different subjects forming the vignette at the end were taken. This Shark appears to be known to several authors in the North of Europe, and has been called *annulatus* by M. Nilsson in his Prodromus of the Ichthyology of Scandinavia, as quoted at the head of the synonymes, on account of the ring-shaped disposition of the coloured markings.

The account of this species in the MS. of Mr. Couch is as follows:—

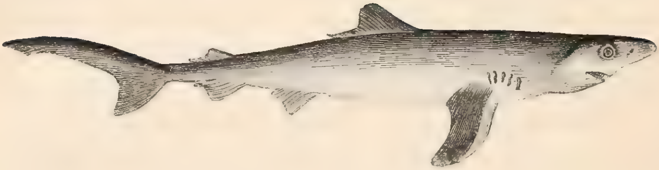
"The specimen from which my description has been taken was caught on a line by a fisherman of Polperro on the 8th February 1834. Its length was twenty-five inches and three-quarters, and seven inches round where stoutest. The head flat on the top, rather wide posteriorly; snout thin, protruded one inch and three-quarters from the anterior angle of the eye; nostrils one inch and a quarter from the snout, double, one beneath linear, the other on the margin, the hinder edge prominent, a depression in the head immediately above it; eye rather large, oval, close behind it a moderately sized temporal orifice; mouth one inch and three-quarters wide; teeth numerous, small, sharp, at each side of the base of each tooth a small sharp process; spiracles five, open; the back somewhat elevated close behind the head; the skin rough against the grain; pectoral fins wide, much like those of the Picked Dog: the first dorsal begins at twelve inches from the snout, and behind the ventral fins; the second at sixteen inches and a half, both rather small: ventrals ten inches from the snout; anal fin four inches long, rather narrow, terminating just opposite the end of the second dorsal; extreme length of the tail seven inches: the upper lobe in a line with the body, bent down towards the termination, rounded, incised, or jagged; under lobe rather narrow in its course, expanded beneath; the upper ridge of the superior lobe has a double row of prickles pointing outward and downward on each side; lateral line suddenly bent opposite the origin of the caudal fin. Colour, a light brown on the head and along the back: on each side two rows of ocellated spots; one row beginning at the side of the neck, and continued along the side of the back; the second row commencing behind the eye and passing along the upper side of the belly, becoming obsolete near the ventral fins; these rows are separated by numerous irregular spots, which, however, assume somewhat of a straight direction; the fins and hinder part of the back are finely barred and clouded with various tints of brown and yellow; the mouth dark-coloured within.

This species is well known in the Mediterranean. Mr. Couch's specimen was that of a male, and the figure is taken from a drawing lent for that purpose.

The vignette represents two of the teeth; the protecting case of the young, which differs in form from that of the Sharks belonging to the genus *Scyllium*, as shown at page 488; and a portion of the skin of the upper part of the tail, showing the arrangement of the large scales on the upper edge, from whence it has obtained the name of *Pristiurus*, or saw-tail.



CHONDROPTERYGII. *SQUALIDÆ.*



THE BLUE SHARK.

Carcharias	*glaucus,*	*Le Bleu,*	Cuvier, Règne An. t. ii. p. 388.
Galeus	,,	*Blew Shark,*	Willughby, p. 49, B. 8.
Squalus	,,	*Le Cagnot bleu,*	Bloch, pt. iii. pl. 86.
,,	,,	*Blue Shark,*	Penn. Brit. Zool. vol. iii. p. 143.
Carcharias	,,	,, ,,	Flem. Brit. An. p. 167, sp. 13.
Squalus	,,	,, ,,	Jenyns, Brit. Vert. p. 499.
,,	,,	*Squale bleu,*	Blainv. Faun. Franç. p. 90.

Carcharias. *Generic Characters.*—One anal and two dorsal fins; the first dorsal placed over the space between the pectoral and abdominal fins. Jaws and head depressed. Teeth flat, pointed, and cutting; serrated in the upper jaw only, sometimes in both jaws. No temporal orifices in adults, but rudiments may be observed in the fœtus of some of the species.

The publication by MM. Müller and Henle of their general work, containing Systematic Descriptions of the Cartilaginous Fishes with Transverse Mouths,* has induced me to modify the arrangement of the Sharks followed in the former edition of this History of British Fishes, and has enabled me also to make useful additions to the generic characters.

The affection of the Blue Shark for its young was the theme of several of the older writers, ichthyologists as well as poets; and mariners of the present day believe that, when danger appears, the young brood enter the mouth of the parent fish, and take shelter in its belly. Living young have doubtless been found in the stomachs of large Sharks: their extraordinary tenacity of life is proverbial, and will account for this; but the safety to be expected from incarceration in such a prison is somewhat problematical.

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* Systematische Beschreibung der Plagiostomen. Berlin, 1841.

The Blue Shark is an inhabitant of the Mediterranean, and appears to occur much more frequently on the Devonshire and Cornish coasts than on any other part of the British Islands; it has been taken in the Bristol Channel, and in Swansea Bay; it has also been taken off the south and east coasts of Ireland, and has been known to wander even as far north as Zetland.

Mr. Couch, who has had frequent opportunities of seeing this species, makes the following observations:—"The Blue Shark is migratory, and I have never known it arrive on the coast of Cornwall before the middle of June; but afterwards it becomes abundant, so that I have known eleven taken in one boat, and nine in another, in one day. The injury they inflict on the fishermen is great, as they hover about the boats, watch the lines, (which they sometimes cut asunder without any obvious motive,) and pursue the fish that are drawn up. This, indeed, often leads to their own destruction: but when their teeth do not deliver them from their difficulty, they have a singular method of proceeding, which is by rolling the body round so as to twine the line about them throughout its whole length; and sometimes this is done in such a complicated manner, that I have known a fisherman give up any attempt to unroll it as a hopeless task. To the Pilchard drift-net this Shark is a still more dangerous enemy, and it is common for it to pass in succession along the whole length of the net, cutting out, as with shears, the fish and the net that holds them, and swallowing both together."

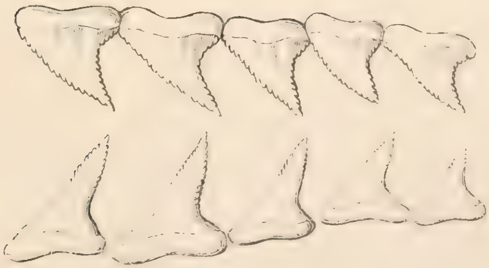
Mr. Couch has lately ascertained that the Blue Shark produces its young early in June.

The specimen described measured fourteen inches; the head depressed, broadest between the eyes, which are lateral; half-way between the eyes and the point of the nose are the nostrils, linear, directed obliquely downwards and backwards, the most inferior portion covered with a valvular fold of skin; the eyes round and rather large; the mouth forming half a circle, the teeth in this specimen very minute,—the cutting teeth of the left side in the representation at the end belong to this species, in each jaw of which there are three rows, those immediately in the centre, to the number of four, being calculated more for holding than cutting; the number of rows of teeth in the Sharks are said, and I believe correctly, to increase with age, and vary in this species from one to six. The branchial apertures are five, the fourth placed over the line of the anterior edge of the pectoral fin; the pectoral fins large and falciform; the body of the fish deepest in the line of their origin, but becoming more compressed and tapering from thence to the tail; the first dorsal fin situated over the space between the pectoral and anal fins, rather small, low and rounded above, with a horizontal projecting elongation at the base behind: the ventral fins small, obliquely truncated, and placed under the space between the first and second dorsal fins; the anal fin placed half-way between the ventral fins and the lower lobe of the tail, opposed to or under the second dorsal fin, and each ending in a prolongation directed backwards; the tail divided, the upper lobe two-thirds longer than the lower, the vertebral column continued along it; the inferior lobe somewhat triangular in shape; the upper lobe falciform, and with an extension of the membrane towards the extreme end.

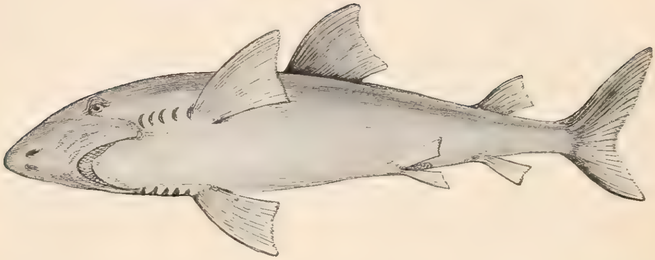
The whole of the upper surface of the head, back, both dorsal fins, and most of the tail, are of a fine slate blue ; the irides, upper surface of the pectoral and ventral fins, are also blue ; the lower part of the sides, under surface of the head, neck, pectoral fins, belly, ventral fins, and the anal fin to the base of the tail, white. The skin of this Shark has a granulated appearance on the surface, and is only slightly rough to the touch on passing the finger in the direction from the tail towards the head.

For a reference to habits see volume i. page 171, in the account of the Pilot-fish.

The teeth represented below are the five first, and from the outermost row in the upper and under jaw, beginning from the centre of the mouth in front, and occupying a short space along the left side. The teeth of the Sharks generally diminish gradually in size from the front backwards, and when they are pointed and curved, the point is directed backwards on both sides of the mouth towards the posterior angle of the gape.



CHONDROPTERYGII. *SQUALIDÆ.*



THE WHITE SHARK.

Carcharias vulgaris,	*Le Requin,*	Cuvier, Règne An. t. ii. p. 387.
,, ,,	*White Shark,*	Flem. Brit. An. p. 167, sp. 12.
Canis Carcharias,		Willughby, p. 47, B. 7.
Squalus ,,	*White Shark,*	Penn. Brit. Zool. vol. iii. p. 139.
,, ,,	,, ,,	Jenyns, Man. Brit. Vert. p. 497, sp. 186.
,, ,,	*Le Squale Requin,*	Blainville, Faun. Franç. p. 89.

This species has been noticed by several English authors, but apparently not from specimens which had been examined by them personally. Low says that, according to information given him, it is sometimes met with among the Orkney Islands. Grew, in his Rarities of Gresham College, page 90, states that they are sometimes found upon our own coast near Cornwall. As it appears to be well known in the Mediterranean, and to be a great wanderer, the Cornish coast is a very probable locality, and it, or the fish figured in the vignette, may prove to be the Rashleigh Shark of Mr. Couch.

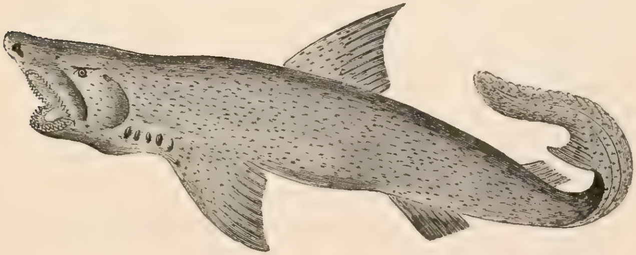
This fish acquires a large size, and with another species, not very dissimilar in shape and equally powerful, are the terror of mariners in most of the warm countries of the globe. It swims with great ease and swiftness from the large size of its pectoral fins; and when caught with a baited hook at sea, and drawn upon deck, the sailors' first act is to chop off its tail to prevent the mischief otherwise to be apprehended from its great strength.

Cuvier, in the *Règne Animal*, says the only good figure of this fish is that in Belon, page 60; and having no access to a specimen, that figure has been carefully copied, and the following description is from M. Risso.

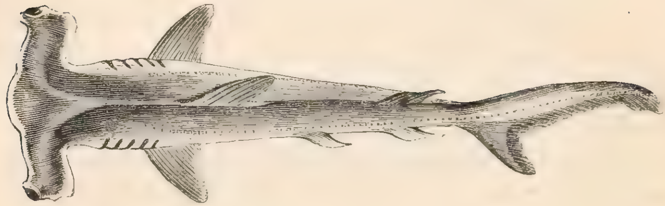
The body is elongated, covered with a hard skin, ash brown above and whitish below. The head is large; the muzzle depressed, short, and pierced with numerous pores: the mouth is large and wide; the tongue short and rough: the upper jaw furnished with six rows of triangular teeth, thin, nearly straight at the edges, and serrated; in the under jaw four rows, sharper than those above, but less compressed: the irides are pearl white; pectoral fins very large; the first dorsal fin elevated; the ventral fins small; the anal fin is opposed to the second dorsal; the tail is divided, forming two lobes, of which the upper lobe is the longest.

It is most frequently seen in the Mediterranean during spring and autumn.

The vignette represents another species, which has also been called White Shark, and may assist observers on the coast.



CHONDROPTERYGII. *SQUALIDÆ.*



THE HAMMER-HEADED SHARK.

Zygæna malleus. Val.

Zygæna,	Belon, p. 61.
,,	Rondelet, 1554, p. 389.
Marteau	,, 1558, p. 304.
Zygæna,	Salvianus, tab. 40.
,, *Salviani,*	Willughby, p. 55, B. 1.
Squalus zygæna,	Linn. Syst. Nat. t. i. p. 399, sp. 5.
,, ,,	Duhamel, sect. IX. pl. XXI. fig. 3.
Squale marteau,	Lacepede, t. i. p. 257, 4to. edit.
,, ,,	,, t. v. p. 443, 8vo. edit.
,, ,,	Risso, Icht. p. 34.
Zygæna malleus,	,, Hist. p. 125.
,, ,,	Val. Mem. du Mus. t. ix. p. 222.

Zygæna. *Generic Characters.*—Head depressed, more or less truncated in front, the sides extended horizontally to a considerable length, with the eyes at the external lateral extremity. Teeth of the same shape in the upper and lower jaw, viz. the points directed towards the corner of the mouth, with a smooth edge when young, but distinctly serrated in adult specimens. Branchial openings five. Two dorsal fins, the first in a line close behind the pectorals; the second over the anal fin.

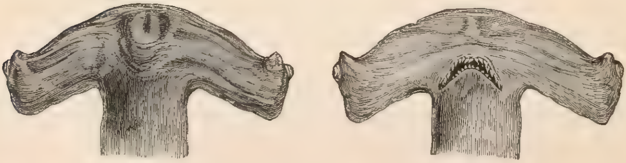
In the sketch of the Natural History of Yarmouth and its Vicinity, by C. J. and James Paget, which I have frequently had the pleasure to refer to in the History of the British Birds, and also in the British Fishes, it is stated at page 17 that a specimen of the *Squalus zygæna*, or Hammer-headed Shark, was taken there in October 1829, and deposited in the Norwich Museum; and by the kindness and influence of J. H. Gurney, Esq. of Norwich, I have had the loan of drawings that were made from this Shark sent to London for my use in this work.

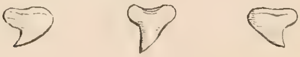
In August 1839 another example of this species of Hammer-headed Shark was taken in a herring-net off the Monkstone rocks, about two miles to the west of Tenby. Of the capture of this fish I was favoured with notices from the Rev. T. Salwey of Tenby, Dr. John Ford Davis of Bath, and J. Dillwyn Llewelyn, Esq. of Penllergare. The latter gentleman has published an account, with measurements of the fish and other particulars, in a paper communicated to the Royal Institution of South Wales; and Mr. Salwey's obliging letter contained an excellent outline of the form, with various measurements. The whole length of the fish, when fresh, was ten feet three inches; the circumference of the body six feet, and it was supposed to weigh between six and seven hundred pounds: the teeth were in six rows, flat, pointed, curved and sharp; the back of a dark greenish lead colour, and reddish yellow on the belly. When opened on the third day after capture, the body contained thirty-nine young ones, perfectly formed, and each about nineteen inches in length.

Among the numerous species included in the genus *Squalus* of Linnæus, — and I might say, indeed, in the whole class of Fishes,— there is no form more extraordinary than that of the Hammer-headed Sharks, four species of which are noticed in the memoir by M. Valenciennes here quoted, where they are considered as a sub-genus, under the name of *Zygæna*.

The Hammer-headed Shark taken on the coast of Norfolk and at Tenby, being also a native of the Mediterranean Sea, has been long known, and is figured in the works of Belon, Rondelet, and Salvianus, as already quoted. The figure at the head of this article is taken from the *Fauna Italica* of the Prince of Canino. Its greatest singularity consists in the extraordinary form of the head; but its habits, as far as they are known, afford no physiological illustration of this very remarkable structure. In other respects it is very like the Sharks in general. This species is said to be ferocious, to frequent deep water, and measures from seven to eight feet in length. Baron Cuvier states that it has been known to attain the length of twelve feet. The female produces many young ones, which are of considerable size at the end of autumn. In some countries the flesh of several species of Sharks is eaten, but that of the Hammer-headed Shark is said to be not only hard, but very unpleasant both in smell and flavour.

The head of this Shark,—representations of the upper and under surface of which, on a small scale, are given below,—measured from one eye to the other, is very large and wide; the eyes are furnished with eye-lids, which arise from the internal part of the orbits, the irides are golden yellow, the





pupils black; the nostrils are elongated, and open immediately underneath the depression, or notch, in the anterior margin of the laterally expanded portions of the head; the mouth semicircular, and furnished with three, four, or five rows of teeth, depending upon the age of the specimen; these teeth are large, sharp, somewhat triangular and curved, with smooth cutting edges when the Shark is young, but serrated afterwards; the teeth in the upper jaw having their points directed towards the angle of the mouth; those of the lower jaw have the same direction, but they are narrower.

The body is elongated, covered with a skin slightly granulated; the colour greyish brown above, nearly white beneath: branchial openings five, all before the base of the pectoral fin; the pectoral fins nearly triangular; the first dorsal fin large; the second small, and placed just in advance of the commencement of the tail; the inferior lobe of the tail small, the superior portion as long as the head of the fish is wide; the anal fin is under the second dorsal.

This species is found in the Mediterranean, on the shores of the various countries of Europe, in the Ocean, and on the coast of Brazil.

To make this subject as complete as my means will allow, and afford an opportunity of identifying any other species of *Zygæna* that might wander to our shores, I here add, as a vignette, representations of the heads of the other known species, of which No. 1 is *Zygæna tudes*, Val. the synonymes being, according to M. Valenciennes, *Le Squale pantouflier* of Lacépède, t. i. p. 260, pl. VII. fig. 3. Duhamel, sect. IX. pt. ii. pl. XXI. fig. 4 to 7. Koma Sora Russel, pl. XII. This species has been found in the Mediterranean, on the coast of Coromandel, and at Cayenne, S. America.

No. 2. *Zygæna Tiburo*, Val. syn. *Squalus Tiburo*, Linn. tom. i. p. 399, sp. 6. *Tiburonis species minor*, Marcg. 181. Willughby, tab. B. 9, fig. 3. Klein Misc.

Pisc. III. p. 13, tab. II. figs. 3, 4. This species has only as yet been met with on the coast of Brazil.

No. 3. *Zygæna Blochii*, Cuv. *Règne An.* t. ii. Bloch, pl. 117. The locality from which this species was obtained is unknown, but specimens are still preserved.

No. 4. *Zygæna laticeps*, Cantor. This is a new species lately described and figured by Dr. Theodore Cantor, who obtained it in the Bay of Bengal, and in which the head is still wider than in either of the other known species; a straight line drawn from the one eye to the other is equal to about one half of the total length of the fish.

In shape the fins are like those of the four species already known; the only difference I have observed, says Dr. Cantor, is the situation of the anal fin, which in the present species is somewhat anterior to the second dorsal, while these fins in the others are opposite.

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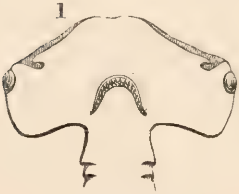

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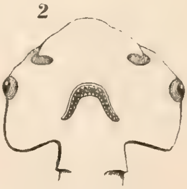

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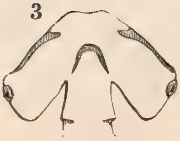

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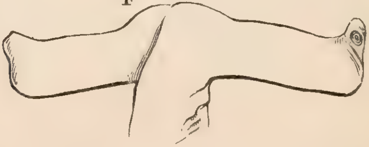
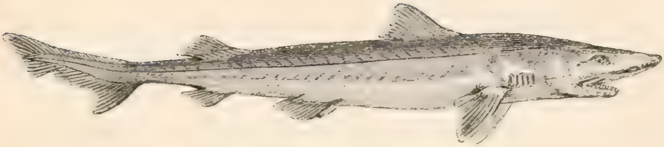




THE COMMON TOPE.

PENNY DOG, *Hastings.* — MILLER'S DOG, *Cornwall.*

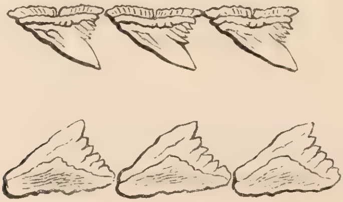
Galeus vulgaris,	*Le Milandre,*	CUVIER, Règne An. t. ii. p. 389.
Canis galeus Rondeletii,		WILLUGHBY, p. 51, B. 6, fig. 1.
Squalus galeus,	LINNÆUS.	BLOCH, pt. iv. pl. 118.
,, ,,	*Tope Shark,*	PENN. Brit. Zool. vol. iii. p. 146, pl. 18.
Galeus vulgaris,	*Common Tope,*	FLEM. Brit. An. p. 165, sp. 6.
Squalus galeus,	,, ,,	JENYNS, Man. Brit. Vert. p. 501, sp. 191.
,, ,,	NILS. Prod. p. 115.	
,, ,,	*Le Milandre,*	BLAINV. Faun. Franç. p. 85.
Galeus canis,	BONAP. Faun. Ital. fasc. viii.	

GALEUS. *Generic Characters.*—Fins in number and position as in the last described genus. Head flat and rather long; temporal orifices present; teeth pointed, concave, and serrated on the outer edge in both jaws.

THE TOPE is a common species along the southern coast, where it is known by the names of Penny Dog and Miller's Dog; it has also been noticed by Pennant in Flintshire; and by others in different parts of the coast of Ireland. It is not, however, considered so plentiful in the north, but has been taken about Berwick Bay, and its occurrence recorded by Dr. Johnston in his address to the Members of the Berwickshire Natural History Club for the year 1832. It has also been taken in the Frith of Forth, as recorded by Dr. Parnell.

On the Cornish coast this is a common and rapacious species; but it is not so destructive as the Blue Shark. The larger specimens, which are about six feet long, abound chiefly in summer; and the young, to the number of thirty or more, according to Mr. Couch, are excluded all at once from the female in May and June. They do not reach the full size until the second year, and continue with us through the first winter, while those of larger size retire into deep water. No use is made of this species beyond melting the liver for oil. When caught on a fisherman's line, this fish sometimes has recourse to the same attempt at deliverance as the Blue Shark, by twisting the line throughout the whole length round its body.

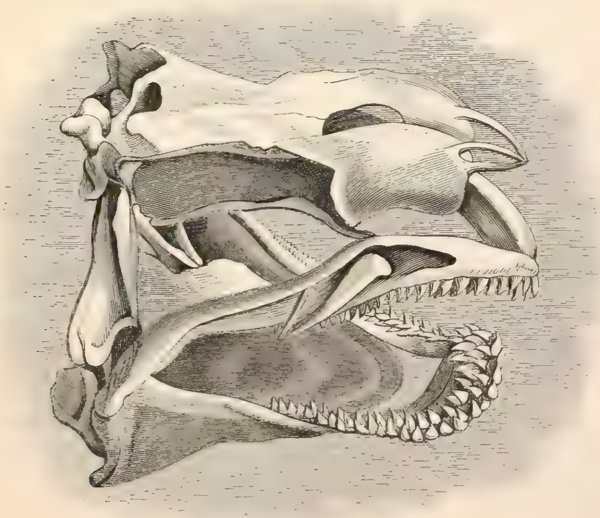
Body fusiform: the skin almost smooth; lateral line straight; the first and second dorsal fins rather small, triangular, very slightly convex on their posterior edges, both ending in points directed backwards; the first dorsal fin placed over the interval between the pectoral and ventral fins; the second immediately over the anal fin, and a little larger than it in size: the head is rather large; the muzzle elongated and depressed; nostrils pierced very near the mouth, in part closed by a membrane; the eyes moderate, and over the mouth; temporal orifices small; the jaws semicircular; teeth small, in several rows, and very nearly alike both above and below, triangular and denticulated on the outer side; the branchial apertures are small, placed near together, the four first nearly equal in size, the fifth the



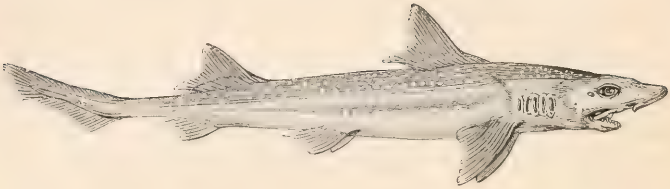
smallest, and placed over the anterior edge of the pectoral fins; the pectoral fins are of moderate size, and triangular in shape; the ventral fins small, near the middle of the whole length, and under the space between the first and second dorsal; the tail rather less than half the length of the body, with a bi-lobed fin; the upper lobe terminal, oblique, and truncated; the inferior lobe with one deep triangular elongation, and a smaller one near the end.

All the upper part of the body and sides are of a uniform slate grey, the under surface lighter in colour, inclining to greyish white.

The vignette represents the head of a Shark.



CHONDROPTERYGII. *SQUALIDÆ.*



THE SMOOTH HOUND.

SKATE-TOOTHED SHARK. RAY-MOUTHED DOG, *Cornwall.*

Mustelus lævis,	*L'Emissole,*	Cuvier, Règne An. t. ii. p. 389.
Squalus mustelus,	Linnæus.	Willughby, p. 60, B. 5, f. 2.
,, ,,	*Smooth Shark,*	Penn. Brit. Zool. vol. iii. p. 151.
Mustelus lævis,	*Smooth Hound,*	Flem. Brit. An. p. 166, sp. 4.
Squalus mustelus,	,, ,,	Jenyns, Man. Brit. Vert. p. 502, sp. 192.
,, ,,	*lævis,*	Blainv. Faun. Franç. p. 84.
Mustelus Plebejus,		Bonap. Faun. Ital. fasc. viii.

Mustelus. *Generic Characters.* — The same as in the last genus, *Galeus,* except the pointed teeth, which in this are flat, like those of the Skate.

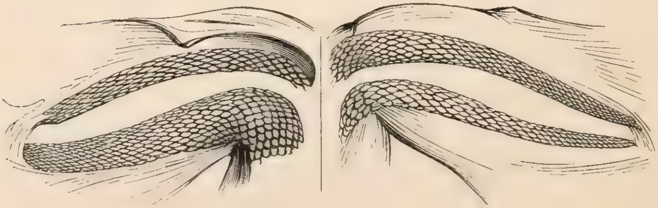
This Shark is rather a common species round our coast. It is occasionally taken in the Frith of Forth ; and Dr. Fleming says the flesh of it is used as food in the Hebrides, and is esteemed a delicate dish. I have received this Shark from Dr. Johnston of Berwick, and have seen it at various places on the coasts of Kent and Sussex. It is called Smooth Hound, from the comparative softness of its skin in reference to British Sharks in general ; and it is also called Ray-mouthed Dog in Cornwall, from the form of its teeth, which are flat and without prominent points, like those of the female or young male of the Thornback. The vignette represents an inside and an outside view of one half of the mouth and teeth of this Shark, which are so different from those of any other British Shark as to serve the purpose of a distinguishing character. The peculiarity in the form and arrangement of these teeth, so closely resembling those of the Skate, is seen by comparing the vignette before referred to with that representing the teeth of the Thornback, which is given hereafter, when describing the first species of true Skate.

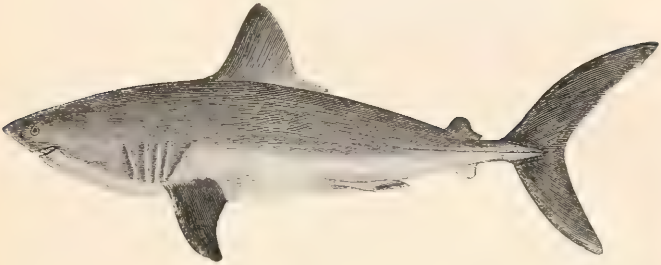
The young of the Smooth Hound frequently have numerous small white spots above the lateral line; but the teeth and other characters agree so closely with the spotless grey examples of larger size, that I am induced to consider these spots only as marks of youth, which may also be observed in other species, particularly in the Picked Dog-fish, *Spinax Acanthias*, Cuvier: and in this view I am further confirmed by the opinions of Mr. Couch and Dr. Johnston.

Mr. Couch says of this species, in reference to its habits, that it is common, but not abundant, and keeps close to the bottom on clean ground, where it feeds on crustaceous animals, which it crushes previous to swallowing, and for which its flat pavement-like teeth are well adapted: it also takes a bait, but is less rapacious than most of the tribe. The young are produced alive in November, the whole coming to perfection at once; but they are few in number, not perhaps exceeding a dozen, and soon after birth they all go into deep water, from which they do not emerge until the following May.

This species has been taken on the coasts of the counties of Antrim and Londonderry.

The specimen described measured eighteen inches in length; the top of the head flat and rather broad; the beginning of the back elevated and rather rounded; the eye large, lateral, elongated horizontally; temporal orifices rather small, and placed immediately behind the posterior angle: first dorsal fin considerably larger than the second; both of the same shape, with an elongated free point at the base projecting backward, the centre of the first dorsal at the distance of six inches, and that of the second at twelve inches, from the point of the nose. Under surface of the head flat; nostrils semilunar in shape, with a central free cutaneous valve: the mouth half the width of the whole under surface, rather angular in shape than semicircular; upper lip on each outside ending in a free elongation of the membrane; the teeth small, flat, like those of a young Skate; pectoral fins large, commencing at three inches and a half from the point of the nose; ventral fins under the space between the two dorsals; the anal fin begins in a line under the middle of the second dorsal fin, but being only half its size, ends but a little behind it: the upper part of the caudal fin is a long narrow horizontal slip; the free part of the under portion is made up of two triangular portions, the first of which is long, the second and last short. The surface of the body smoother than that of Sharks in general: the colour of the upper part of the head, body, and fins, pearl grey; under parts greyish yellow white: lateral line prominent; above it the body along its whole length is marked with numerous small circular white spots, which, as before stated, are most conspicuous while this fish is young.





THE PORBEAGLE,

OR BEAUMARIS SHARK.

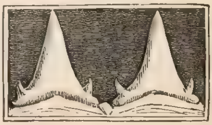
Lamna Cornubica,	*Le Squale Nez,*	Cuvier, Règne An. t. ii. p. 389.
,, ,,	*Porbeagle,*	Flem. Brit. An. p. 168, sp. 15.
Squalus Cornubicus,	,,	Penn. Brit. Zool. vol. iii. p. 152 & 254, pl. 20.
,, ,,	,, *Shark,*	Don. Brit. Fish. pl. 108.
,, ,,	,,	Goodenough, Linn. Trans. vol. iii. p. 80, tab. 15.
,, ,,	,,	Jenyns, Man. Brit. Vert. p. 500 & 501.
,, ,,	Nilss. Prod. p. 116.	
Lamna Cornubica,	Bonap. Faun. Ital. fasc. xiii.	

Lamna. *Generic Characters.*—Two dorsal fins, the first but little behind the line of the pectoral fin; the second dorsal fin over the anal. Skin smooth. Head pointed; nose pyramidal; nasal valves small. Temporal orifices, or spiracles, very small, at a distance behind the eye. Teeth flat, triangular, smooth, sharp, cutting, with a small denticle at the base on each side in adults. Branchial openings large.

In the former edition of this work, I had, with others, considered the Beaumaris Shark distinct from the Porbeagle, but opportunities of examining four specimens which have been taken on different parts of our coast since 1837 induce me to believe that the differences observed are only the effects of greater age, and I have therefore now brought them together, believing them to form but one species.

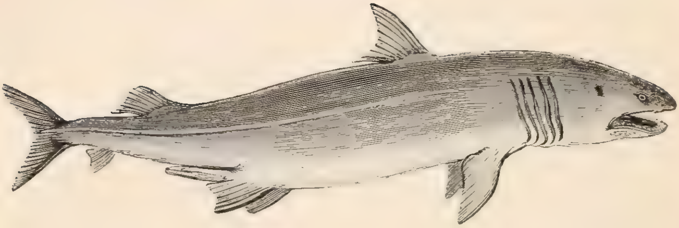
The Porbeagle occurs occasionally on the northern and on the southern coasts of this country, and is mentioned as having been taken at Belfast. The specimen described and figured by Dr. Goodenough in the Transactions of the Linnean Society, as quoted, was taken at Hastings; Mr. Couch has seen it occasionally in Cornwall, and it was figured by Dr. Borlase in his history of that coast. Mr. Couch states of this species, "That it associates in small companies in pursuit of prey, from which circumstance, and a distant resemblance to the Porpus, they derive their name. I have found the remains of cartilaginous fishes and Cuttles in their stomachs, and in one instance three full-grown Hakes. This species attains a large size at an early age, so that I have found it cutting its second row of teeth when nearly full-grown."

On the northern and north-east coast it occurs most frequently during autumn, and, not to multiply descriptions already in print, I shall here insert one furnished by Dr. George Johnston of Berwick, who examined two specimens in the autumn of 1834, both of which were taken in Berwick Bay, and who also very kindly sent me, with his description, a portion of a jaw, from which the teeth here inserted were drawn. Of these teeth there were three rows, the third or inner row being much smaller than the teeth of the two preceding rows, and perhaps only recently exposed.



Body fusiform, very narrow at the tail, and strongly keeled there on each side; skin smooth when stroked backwards, of a uniform greyish black colour, the belly white; snout obtusely pointed, with a band of punctures on each side of the forehead terminating above the eyes, a few similar punctures behind the eyes, and a triangular patch of them before the nostrils; they are the apertures of canals filled with a transparent jelly: eyes round, dark blue; branchial slits five, cut across the neck, the posterior oblique and close to the pectoral fin; back rounded; dorsal fin triangular, with a free pointed pale-coloured process behind; posterior dorsal fin also pointed posteriorly; pectorals somewhat triangular, obliquely sinuate on the posterior edge, black; ventral fins rhomboidal, meeting at the mesial line, on which are the anal and generative apertures; anal fin small, pointed behind; tail lunate, with unequal lobes, the superior and largest with a projecting outline near the tip; above the tail there is a flat space bounded by a short transverse ridge, and a similar one opposite on the ventral side: lateral line straight; the keel on the body runs forward on the tail, and there is a small keel beneath this confined to the tail itself. The length along the lateral line, five feet eight inches and a half; circumference in front of the dorsal fin, two feet eight inches and a half; from the snout to the eye four inches and three-quarters; diameter of the eye, one inch and one-tenth: breadth between the eyes, five inches and one-quarter; from the snout to the margin of the upper lip, four inches and a half, thence to the angle of the mouth also four inches and a half; breadth of the mouth from angle to angle, eight inches and one-quarter; snout to dorsal fin, two feet one inch and three-quarters; height of dorsal fin, nine inches and three-quarters; length of dorsal fin, ten inches and one-quarter; length of the free portion of it, three inches; space between the first and second dorsal fins, one foot eight inches; length from the snout to the anal aperture, three feet eight inches; extreme breadth of the tail, one foot eight inches; length of the tail in the mesial line, six inches and one quarter.

CHONDROPTERYGII. *SQUALIDÆ.*



THE BASKING SHARK.

THE SUN-FISH, *and* SAIL-FISH.

Selachus	*maximus,*	*Le Pelerin,*	Cuvier, Règne An. t. ii. p. 390.
Squalus	,,	Linnæus ?	
,,	,,	*Basking Shark,*	Penn. Brit. Zool. vol. iii. p. 134, pl. 16.
,,	,,	*Common Sail-fish,*	Flem. Brit. An. p. 164, sp. 5.
,,	,,	*Basking Shark,*	Jenyns, Man. Brit. Vert. p. 503, sp. 193.
,,	,,	Nilss. Prod. p. 114.	

Selachus. *Generic Characters.*—Two dorsal fins, the first placed but little behind the line of the pectorals, the second over the interval between the ventral and anal fins. The skin rough. Snout short and blunt. Temporal orifices very small. Teeth very small, numerous, conical, edges smooth, no lateral denticles. Branchial openings large, nearly encircling the neck.

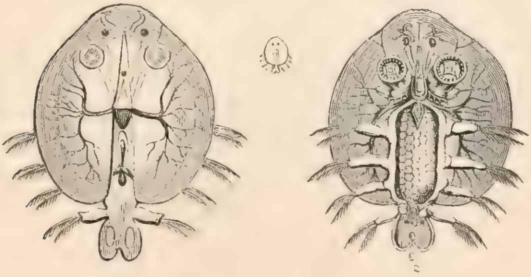
The Basking Shark, so called from its habit of remaining occasionally at the surface of the water almost motionless, as if enjoying the influence of the sun's rays, whence it is also on some parts of the Irish and Welsh coasts called Sun-fish, is one of the largest of the true fishes, and has been known to measure thirty-six feet in length. It has been seen generally from the month of June to the commencement of winter. When northerly winds prevail, it is most frequent on the west coast of Scotland. It has also been seen on the north and on the west coasts of Ireland. If westerly winds prevail, it is not unusual to see them along the whole line of the southern coast. It has been taken on the coasts of Waterford, Wales, Cornwall, Devonshire, Dorsetshire, and several times at different places on the coast of Sussex. The specimen described and figured by Sir E. Home, in the Philosophical Transactions for 1809, was taken off Hastings; and the largest specimen I have seen, which measured thirty-six feet in length, was caught some years since off Brighton. From our southern coast it frequently wanders as far to the eastward and south as the coast of France; and the fish described and figured by M. de Blainville in the eighteenth volume of the *Annales du Muséum*, I have very little doubt was of the same species as that described by Sir E. Home, which has been already referred to.

The difficulty of obtaining a perfect view of this unwieldy fish, either when floating in water, or when from its great weight it lies partly imbedded in the soft soil of the sea-shore, has led to the differences which appear in the representations of it which have been published by different naturalists.

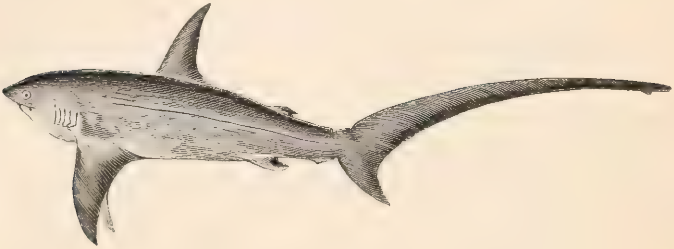
The Basking Shark is said to exhibit but little of the ferocious character of the Sharks in general, and is so indifferent to the approach of a boat as to suffer it even to touch its body when listlessly sunning itself at the surface. From its habit of swimming slowly along with its dorsal fin, and sometimes part of its back, out of water, it has obtained in the North the name of Sail-fish. In Orkney it is called Hoe-mother, and by contraction Homer,—that is, the mother of the Picked Dog-fish, which is there called the Hoe. If deeply struck with a harpoon, the Basking Shark plunges suddenly down, and swims away with such rapidity and violence as to become a difficult as well as a dangerous capture. This species has the smallest teeth in proportion to its size of any of the Sharks. No remains of fish have been found in its stomach. One examined by Mr. Low contained a red pulpy mass, like bruised crabs, or the roe of *Echini.* Mr. Low adds, that this Shark's appearance, manners, and weapons do not indicate it to be a ravenous fish. Linnæus says that its food is *Medusæ*, and Pennant considered that it subsisted on marine plants.

The body is thickest about the middle, and diminishes towards both extremities; when afloat the form is nearly cylindrical; the skin thick and rough, of a brownish black colour, with tints of blue. The head conical, the muzzle short, rather blunt, smooth, and pierced with numerous circular pores; eyes near the snout, small, oval, the elongation horizontal, the irides brown; half-way between the eye and the first branchial opening is the temporal orifice, oblique and small; branchial openings five on each side, of great vertical length, each set including the whole side of the neck, and leaving only a small space above and below; nostrils oval, small, placed rather laterally, and opening on the edge of the upper lip, pectoral fins of moderate size for so large a fish,—perhaps, as before stated, the largest of the true fishes,—the form somewhat triangular, placed close to the last branchial orifice, convex anteriorly and thick, slightly concave and much thinner behind; the ventral fins also of moderate size, rather elongated at the base, placed behind the middle of the whole length of the fish, convex in front, concave behind, the inner and posterior half free, exhibiting in the figure chosen the cylindrical appendages peculiar to the male. The first dorsal fin, placed before the middle of the whole length of the fish, is much the larger of the two, forming an elevated triangle; anterior edge but slightly convex, posterior edge concave, with an elongated point at the base directed backwards: the second dorsal fin much smaller than the first; rounded above, attached throughout half its base only, and placed at two-thirds of the distance from the first dorsal to the caudal fin; the anal fin is still smaller than the second dorsal, but of the same shape. From the line of the anal fin to the base of the tail there is a strong and prominent keel-like edge on each side, and just in advance of the base of the caudal fin, both above and below, is a groove,—that underneath rather smaller than that above. The caudal fin divided into two lobes, the upper one larger than the lower; the posterior edge of the caudal fin appears to become notched and abraded by age and use, and is frequently found unequal at its margin, and variable in shape.

The vignette below represents the *Argulus foliaceus* of Jurine; another species of parasitic animal occasionally found attached to fresh-water fishes. I have specimens that were taken from the Pike and the Trout. The figure on the left-hand represents the upper surface of a male: by the powers of the microscope some of the vessels of the body are rendered visible through the external tunic. The figure on the right-hand represents the under surface of a female: the ova are very conspicuous. The small figure between the two is of the natural size.



CHONDROPTERYGII. *SQUALIDÆ.*



THE FOX SHARK.

SEA-FOX. THRESHER. SEA-APE.

Carcharias vulpes,	*La Faux, ou Renard,*	Cuvier, Règne An. t. ii. p. 388.
,, ,,	*Thresher,*	Flem. Brit. An. p. 167, sp. 14.
Vulpes marina,	Willughby, p. 54, B. 6, fig. 2.	
Squalus vulpes,	*Long-tailed Shark,*	Penn. Brit. Zool. vol. iii. p. 145.
,, ,,	*Sea-Fox,*	Jenyns, Brit. Vert. p. 498.
,, ,,	*Le Squale Renard,*	Blainv. Faun. Franç. p. 94.
Alopias ,,	Bonap. Faun. Ital. fasc. xiii.	

Alopias. *Generic Characters.*—Head, dorsal and anal fins, and spiracles, as in the genus *Lamna;* upper lobe of the tail very long, with a depression at the base. Teeth triangular, flat, with smooth cutting edges in both jaws, curving outwards on each side from the centre. Branchial openings small, the last over the pectoral fin.

This species is occasionally met with on the British coast: Pennant examined one that measured thirteen feet in length; and specimens have been seen of fifteen feet long. It is called the Sea-Fox from the length and size of its tail; and, according to Dr. Borlase, has received the name of Thresher from its habit of attacking other animals, or defending itself, by blows of the tail.[*] It is an inhabitant of the Mediterranean as well as other seas; and a specimen has been taken near Belfast.

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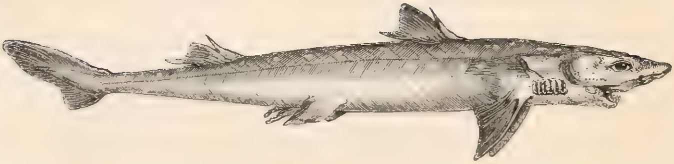
[*] See vol. i. p. 165.

The extreme length of a Fox-Shark examined by Mr. Couch, "was in a straight line ten feet ten inches, and along the curve eleven feet eight inches; three feet four inches round where thickest; solid at the chest; conical from the snout to the pectoral fins, and thick even to the tail, which organ from the root was five feet and a half long, and consequently more than half the length of the body; eye prominent, round, hard, four inches from the snout; iris blue, pupil green: the nostrils small, and not lobed; mouth five inches wide, shaped like a horse-shoe; teeth flat, triangular, in two or three rows, not numerous; spiracles five; pectoral fins wide at the base, pointed, eighteen inches and a half long. Measured along the curve, from the snout to the first dorsal fin, was two feet five inches, the fin triangular; from the first dorsal to the second, fourteen inches and a half; this and the anal fin small; ventral fins also rather small, triangular; above and below at the base of the tail a deep depression; skin smooth; lateral line central and straight; breadth of the tail, including both lobes, thirteen inches; the upper lobe narrow throughout its great length, and on the lower margin, at four inches from the extremity, is a triangular process. Colour of the body and fins dark blue, mottled with white over the belly."

Mr. Couch says it is not uncommon for a Thresher to approach a herd of Dolphins (*Delphini*) that may be sporting in unsuspicious security, and by one splash of its tail on the water put them all to flight like so many hares before a hound.

"The specimen here described was taken at the entrance of the harbour of Looe in Cornwall, in October 1826, having become entangled in a net set for Salmon. The stomach was filled with young Herrings."

CHONDROPTERYGII. *SQUALIDÆ.*



THE PICKED DOG-FISH.

BONE-DOG, *Sussex.*—HOE, *Orkney.*

Acanthias	*vulgaris*,	Risso, Hist. vol. iii. p. 131.	
Spinax	*acanthias*,	*L'aiguillat*,	Cuvier, Règne An. t. ii. p. 391.
Galeus	,,	*sive spinax*,	Willughby, p. 56, B. 5, f. 1.
Squalus	,,	Linnæus. Bloch, pt. iii. pl. 85; the young, pt. iii. pl. 75, fig. 1.	
,,	*spinax*,	*Picked Shark*,	Penn. Brit. Zool. vol. iii. p. 133.
,,	*acanthias*,	,, ,,	Don. Brit. Fish. pl. 82.
Spinax	,,	*Common Dog-fish*,	Flem. Brit. An. p. 166, sp. 10.
Squalus	,,	*Picked Dog-fish*,	Jenyns, Man. Brit. Vert. p. 505, sp. 194.
,,	,,	Nilss. Prod. p. 117.	
,,	,,	Blainv. Faun. Franç. p. 57.	
Spinax	*acanthias*,	Bonap. Faun. Ital. fasc. viii.	

Acanthias. *Generic Characters.* — Two dorsal fins, with a spine before each; first dorsal behind the line of the pectorals; the second dorsal over the space between the ventral and caudal fins; no anal fin. Skin rough in one direction; the scales heart-shaped, with a central spine directed backwards. Temporal spiracles large. Several rows of teeth in both jaws, cutting and sharp, the points directed outwards and backwards.

The Picked Dog-Fish is a very common species, at once distinguished from the other British Sharks by the single spine placed in advance of each of its two dorsal fins,—a weapon from which it derives its specific appellation, pick being synonymous with pike or spike. Among the Scotch islands, where it is called the Hoe, it appears most numerous at the full and change of the moon, on account of the then greater quantity of water, and consequent increased strength or race of the tide in some of the narrow straits. Being gregarious, they frequently make their appearance in such shoals that the fishermen load their boats to the water's edge with them ; and, acccording to Mr. Low, they prove a valuable capture. The flesh is dried and eaten : the livers yield a large quantity of oil, while their intestines and other refuse parts are strewed over the land as manure. Dr. Neill and Dr. Parnell say this species is very common in the Forth during the Herring season, where numbers are caught ; but their flesh is not eaten in that neighbourhood. The Dog-fish is common also at Berwick, and on the north-eastern coast generally.

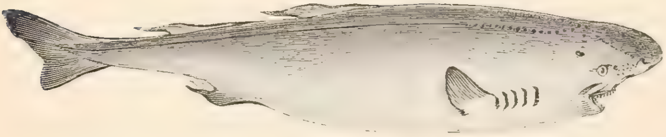
The Picked Dog-fish is found in numbers at most of the fishing stations along the south-eastern coast, round to Kent and Sussex, where it is almost universally called the Bone Dog. According to Montagu's MS. it is very numerous in Devonshire and in Cornwall. Mr. Couch says, " It is the most abundant of the Sharks, and is sometimes found in incalculable numbers, to the no small annoyance of the fishermen, whose hooks they cut from the lines in rapid succession. I have heard of twenty thousand taken in a sean at one time ; and such is the strength of instinct, that little creatures not exceeding six inches in length may be found, in company with the larger and stronger, following schulls of fish, on which at that time it is impossible they should be able to prey. The Picked Dog bends itself into the form of a bow for the purpose of using its spines, and by a sudden motion causes them to spring asunder in opposite directions : and so accurately is this intention effected, that if a finger be placed on its head, it will strike it without piercing its own skin.

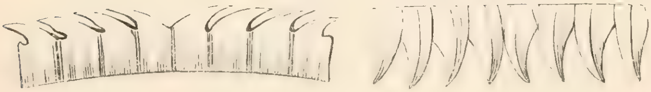
This fish is subject, like many others, to occasional monstrosity. A friend of mine was in possession of a Picked Dog-fish with two heads, the separation continuing so far back as behind the pectoral fins. The fishermen who found it informed me that there was only one egg attached to it, and that it must have been dropped from the mother after she was taken. The young are produced at various periods from June to November.

This species is common on various parts of the coast of Ireland.

The whole length of the specimen described was eighteen inches; the top of the head flat; the temporal orifices large, and seen from above: first dorsal fin commencing at one-third of the whole length; rather small in size; front edge convex, concave behind; the point of the spine preceding the fin half as high as the fin: the second dorsal fin half-way between the first and the end of the tail; small in size, with a spine as high as the fin: the nose rather pointed; the eyes lateral, elongated horizontally; temporal orifices behind, large, but above the line of the eye; nostrils small, with a minute valve; mouth semicircular, when quite open nearly round; the teeth from the centre of both jaws with points projecting outward on each side, the edges sharp; pectoral fins large, commencing half-way between the snout and the first dorsal; ventral fins small, placed intermediate, in a vertical line, between the first and second dorsal; no anal fin; tail powerful, upper membrane broad, the lower anterior part triangular, ending in a slip prolonged backward. The upper part of the head, body, and fins, slate grey; under parts yellowish white; young specimens generally exhibit a few white spots. Skin moderately rough on passing the finger upwards towards the head; in the contrary direction quite smooth.

CHONDROPTERYGII. *SQUALIDÆ.*





THE GREENLAND SHARK.

Scymnus borealis, Greenland Shark, Flem. Brit. An. p. 166, sp. 11.
Squalus ,, ,, ,, Scoresby, Arctic Regions, vol. i. p. 538, pl. 15, figs. 3, 4.
,, *glacialis, Faber,* Nilsson, Prod. Icht. Scand. p. 116, sp 7.
,, *borealis, Greenland Shark,* Jenyns, Man. Brit. Vert. p. 506, sp. 195.
,, *Norwegianus,* Blainv. Faun. Franç. p. 61.

Scymnus. *Generic Characters.*—All the fins small: two dorsal fins, the first but little before, and the second but little behind, the line of the ventrals; no anal fin. Skin rough. Temporal orifices, or spiracles, large, placed rather high up on the head, above as well as behind the eyes. Teeth in the lower jaw crooked at the point, equilateral at the base; in the upper jaw lancet-shaped, but little curved; the points in both jaws diverging from the centre. Gill-openings small.

This species of Shark, which is a native of the Northern Seas, has been twice noticed in Scotland. According to Dr. Fleming, one was caught in the Pentland Frith in 1803; and another, measuring thirteen feet and a half long, found dead at Burra Frith, Unst, was seen by Mr. Edmonston.

I am indebted to J. Hutchinson, Esq. of Durham, for the knowledge of the occurrence of an example of this species on the coast of Durham in April 1840, and this specimen has been preserved for the Durham University Museum. Mr. Hutchinson's very obliging communication contained various interesting particulars, with a penciled sketch of the fish, the fins, the teeth, and the spinous asperities on the skin, to be hereafter noticed in the description.

This Shark appears to be well known to several Northern zoologists; and the following account is derived from the valuable work on the Arctic Regions by Captain W. Scoresby.

"The *Squalus borealis* is twelve or fourteen feet in length, sometimes more, and six or eight feet in circumference. The opening of the mouth, which extends nearly across the lower part of the head, is from twenty-one to twenty-four inches in width. The teeth are serrated in one jaw, and lancet-shaped and denticulated in the other. It is without the anal fin, but has the temporal opening; the spiracles on the neck are five in number on each side. The colour is cinereous grey. The irides are blue, the pupil emerald green."

"This Shark is one of the foes of the Whale. It bites it and annoys it while living, and feeds on it when dead. It scoops hemispherical pieces out of its body, nearly as big as a person's head; and continues scooping and gorging lump after lump, until the whole cavity of its belly is filled. It is so insensible of pain, that though it has been run through the body with a knife and escaped, yet, after a while, I have seen it return to banquet again on the Whale, at the very spot where it received its wounds. The heart is very small; it performs six or eight pulsations in a minute, and continues its beating for some hours after being taken out of the body. The body, also, though separated into any number of parts, gives evidence of life for a similar length of time. It is therefore extremely difficult to kill. It is actually unsafe to trust the hand in its mouth, though the head be separated from the body. Though the Whale-fishers frequently slip into the water where Sharks abound, there has been no instance, that I have heard of, of their ever having been attacked by the Shark."

"Besides dead Whales, the Sharks feed on small fishes and crabs. A fish, in size and form resembling a Whiting, was found in the stomach of one that I killed; but the process of digestion had gone so far, that its species could not be satisfactorily discovered. In swimming, the tail only is used: the rest of its fins being spread out to balance it, are never observed in motion but when some change of direction is required.

"To the posterior edge of the pupil of the eye is attached a white vermiform substance, one or two inches in length. Each extremity of it consists of two filaments, but the central part is single. The sailors imagine this Shark is blind, because it pays not the least attention to the presence of a man; and is, indeed, so apparently stupid, that it never draws back when a blow is aimed at it with a knife or lance."

The eyes of this Greenland Shark, with the appendages, were brought home by Captain W. Scoresby, preserved in spirits, and submitted to Sir David Brewster, who gave one specimen to Dr. Grant. The appendage proved to be a new species of parasitic animal, which Dr. Grant named *Lernæa elongata*, and described it, adding a figure of it, in the seventh volume of the Edinburgh Journal of Science. The imperfection of the vision of the fish was probably produced by the various perforations made in the cornea by the tentacula of this new species of *Lernæa;* as it is by those organs that these parasitic animals retain their hold and live upon the fluids extracted from the part to which they adhere.

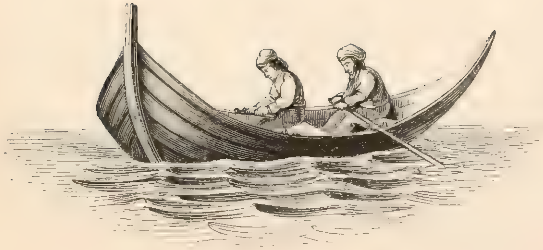
This species of *Lernæa* is perhaps the largest known : it measured three inches in length.

A Shark of this species is the subject of a memoir by M. Valenciennes in the first volume of the "Nouvelles Annales du Muséum," where, on account of the very small size of its fins, it is called *Scymnus micropterus*. This example was found stranded on the sand in the large bay at the mouth of the Seine, about the end of March or the beginning of April 1832. It was bought, and afterwards exhibited at Havre, and was finally sent to Paris, very well preserved, considering its bulk, in a large wooden box saturated with pyroligneous acid. The whole length was thirteen feet. The head and body compressed ; numerous mucous pores, arranged in lines, about the head and neck ; the body deepest in the region of the pectoral fin ; the first dorsal fin smaller than the pectoral fin, and preceded by an elongated ridge or keel on the back of the fish, formed by a fold or duplicature of the skin ; the second dorsal fin preceded also but by a shorter keel : the fish was a male ; the ventral fins and sexual appendages, or claspers, very small ; no anal fin ; the colour dark brown on the back, grey on the belly.

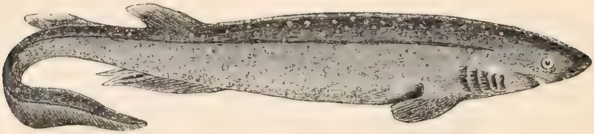
No doubt exists that this species lives in the northern seas, agreeing in dentition with preserved parts of a large Shark brought from North Cape, and also with the fish described and figured by Gunner in the second volume of the Natural History Memoirs of Drontheim, p. 330, plates X. and XI. under the name of *Squalus Carcharias*. M. Blainville, as seen by the synonymes at the head of this subject, calls this species in the "Faun. Franc." *Norwegianus*. Mr. Hutchinson, in his letter to me referring to the Durham specimen, particularly mentions, and shows in his drawing, the small size of the fins, which accounts for the sluggish movements of the fish as described by Captain Scoresby.

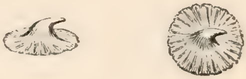
Mr. Hutchinson says the colour of the fish when fresh was brown, deeply shaded with blue ; the blue soon faded, and it became dark brown ; when quite dry it was cinereous brown. The rows of teeth vary in number from two to six, probably depending upon the age of the fish ; I have only figured the outer row in each jaw, that the form might be clearly defined, those on the left being from the lower jaw. The points in all the rows of each jaw diverge from the centre as figured in the single row of each here given under the fish.

The vignette represents the form of row-boat in use on the west coast of Norway, derived from Barrow's visit to Iceland.



CHONDROPTERYGII. *SQUALIDÆ.*





THE SPINOUS SHARK.

Echinorhinus	*spinosus,*	BLAINVILLE, Faun. Franç. Poiss. p. 66, sp. 6.
,,	,,	BONAP. Faun. Ital. fasc. xiii.
,,	*obesus,*	Dr. A. SMITH, Zool. South Afr. No. 1.
Squalus	*spinosus,*	GMELIN, Syst. Nat. I. p. 1500, sp. 27.
,,	,,	LACEPEDE, Hist. Nat. Poiss. 4to. t. i. p. 30, tab. 3, fig. 2; 8vo. t. v. p. 354, pl. 22.
,,	,,	SCHNEIDER, p. 136, sp. 31.
,,	,,	RISSO, Ichth. p. 42, sp. 18.
Scymnus	,,	,, Hist. t. iii. p. 136, sp. 21.
,,	,,	CUVIER, Règne An. t. ii. 1829, p. 393.
Gonoidus	,,	AGASSIZ, Recherches sur les Poiss. Foss.

Generic Characters. Echinorhinus, Blainville. *Gonoidus,* Agassiz.—The first dorsal fin opposite to the abdominal ones. Teeth in both jaws, broad and low, the edge nearly horizontal; the lateral edges have one or two transverse denticles. (1 species.)*

SOON after the publication of that part of the British Fishes which contained the Sharks, I received a communication from Mr. John Hey, then Honorary Curator to the Leeds Philosophical Society, with a coloured drawing of the well known Spinous Shark of authors, a specimen of which had been taken in Filey Bay, on the Yorkshire coast, in the summer of 1830, and therefore entitled to a place among British Fishes; but the whole of the then remaining portion of the work being at that time printed for publication on the 1st of August, 1836, I was unable to avail myself of this interesting information, which came to my hands on the 7th of July.

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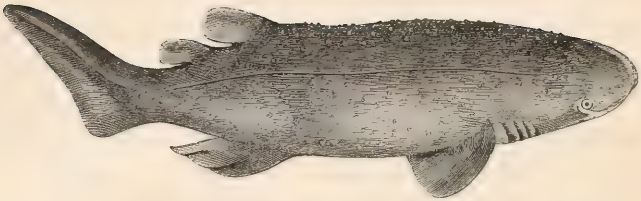
* Müller and Henle. Generic characters of Cartilaginous Fishes. Mag. Nat. Hist. for 1838, p. 89, and Syst. Besch. Plag. 96.

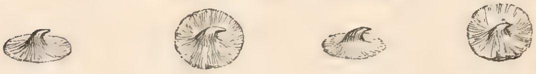
On the 30th of the same month I was favoured with a letter from Dr. H. S. Boase of Penzance, containing an account of the capture of a Spinous Shark on the 23rd of that month, near the Land's End; and Dr. Boase also very kindly sent me in his letter pen-and-ink sketches of two views of this Shark, made to a scale of one inch to a foot, with representations and specimens of the teeth and spines.

In November 1837, the Rev. Robert Holdsworth sent me notice by letter of the capture of a Spinous Shark, taken in a trawl-net off Brixham, with pen-and-ink sketches of the form of the body, with a small portion of its spine-studded skin, and some of its teeth.

At the meeting of the British Association at Newcastle-upon-Tyne, in August 1828, Arthur Strickland, Esq. of Bridlington, exhibited in the section devoted to Natural History a drawing, and read a short description, of a Spinous Shark, which had been recently found on the Yorkshire coast, and was evidently of this species, Mr. Gray referring to the figure of it lately published by Dr. Andrew Smith in the first number of his "Illustrations of the Zoology of South Africa," which the drawing exhibited by Mr. Strickland very closely resembled.

Lastly, I may add that on the 9th of November 1838, the Rev. Robert Holdsworth sent me word that another specimen of the Spinous Shark had been caught on a fisherman's line off Berry Head on the previous Tuesday. I soon afterwards received a notice of this last capture from my





friend Mr. Couch, of Polperro, and also from Mr. Heggerty, of Torquay, to which place, as I understood, this last specimen had been brought for preservation.

Four examples of this Shark are therefore known to have been obtained on our coasts within the last three years, and one in the summer of 1830.

This very remarkable Shark was first described by Broussonnet under the name of *Le chien de mer bouclé*, in the "Memoires de l'Académie des Sciences pour 1780," and, as may be seen by the numerous synonymes at the head of this subject, is a species that is exceedingly well known, having a wide geographical range, extending from the North Sea to the Cape of Good Hope in one direction, and from the shores of Italy into the Atlantic in another.

The specimen described by Broussonnet measured only about four feet in length; but it has been taken upwards of seven feet long on the Cornish coast; and M. Risso mentions that one of four hundred pounds' weight, and therefore probably still longer than the Cornish specimen, was caught by the Mandrague, or Tonnaro fishermen of Nice, in the horizontal nets set up by them to catch Tunnies.

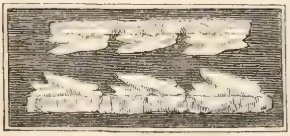
Some differences will be observed in the comparative length and thickness of the figures here given, the first of which is taken from the drawing sent me by Mr. John Hey of the Filey Bay specimen; the second representing, on the other side, a more bulky fish, is taken from Dr. A. Smith's illustrations. The figures given by Lacépède and the Prince of Musignano are rather long and slender, and were probably taken from specimens of small comparative size; the figure sent me by Dr. Boase from a fish more than seven feet long, and the drawing exhibited by Mr. Strickland at Newcastle, more resembled the figure by Dr. Smith. Some specimens are described as being intermediate, and all these differences in the same species may be referred to age or sex, or both, a young male and an old female presenting the greatest contrast. The decided similarity in the teeth, which are very peculiar, and which only differ in size, with the particular character of the skin and its spines, with their radiated bases, leave no room to doubt that these various examples belong to one and the same species.

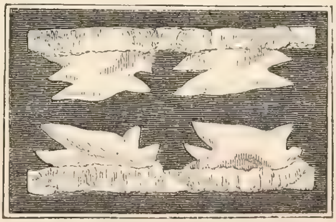
We become a little acquainted with some of the habits of this Shark by noticing the circumstances under which it has been captured. Of the first Cornish specimen, Dr. Boase says, this Shark was caught on the 23rd of July, 1836, west of the Long Slips, Land's End. Just before the moon set the fishermen had been very successful, but all at once lost their sport, or as they expressed it, "the Congers suddenly sheered off to a man." When hooked, it was not more troublesome than a Conger; but when brought to the water's edge, it gave battle, and was secured with great difficulty. The first specimen noticed by the Rev. Robert Holdsworth as caught in a trawl-net off Brixham, had a portion of a Gurnard in its stomach. Of the third specimen, caught on the southern coast, near Berry Head, Mr. Holdsworth says, this Shark was taken near the bottom on a hook baited with cuttle. The men were fishing for Conger Eel, and other large fish, when this Shark was hooked. They describe his action in the water as most powerful, and were obliged to let him run with the line four times to the bottom before they could hamper him with a sliding noose let down over the line to his tail. These lines and the trawl-net only do their work at the bottom, and we may, therefore, conclude that this species is a Ground Shark. As such Cuvier had arranged it in his genus *Scymnus*, and Dr. Andrew Smith, who from his extensive acquaintance with this division of the cartilaginous fishes is an admitted authority, confirms this opinion. Of this Spinous Shark, Dr. Smith says, "This species is comparatively rare at the Cape of Good Hope. It is described by the fishermen as sluggish and unwieldy in its movements, and but seldom to be observed towards the surface of the water. When they obtain specimens, it is generally at a time when they are fishing in deep water, and when the bait with which the hooks are armed is near to the bottom. In this respect it resembles the *Scyllia*, or Ground Sharks; and, if we were to regard only its internal organisation, we should be disposed to consider it as closely allied to that genus."

Never having seen a specimen of this Shark, the following description of its colour and form is derived from Dr. Smith's work.

Colour:—The head and back, as far as the first dorsal fin, dark leaden grey; the rest of the back, the sides, and the belly, pale coppery yellow, clouded with purple and brownish tints; and the belly besides is marked with blotches of light vermilion red; the fins towards their bases reddish brown, tinged with dull grey, towards their extremities a lighter shade of the same colour; chin, sides of muzzle, and sometimes a spot behind the eye, dull white; eyes coppery green.

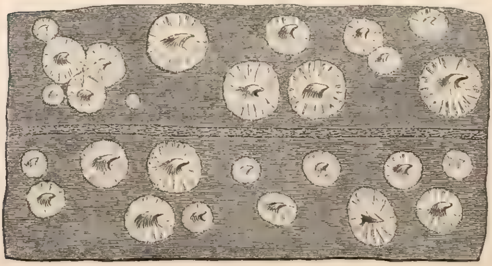
Form, &c.—Body very thick in proportion to its length, with only a slight diminution in size towards the tail; the back in front of the first dorsal fin nearly straight; the head flat above, and slightly sloping to the muzzle, which is rounded; nostrils transverse, and each partially divided by a narrow membranous lobule, which projects backwards from its anterior margin; their position is nearly over the most projecting, or central portion of the upper jaw, considerably nearer to the eyes than the tip of the snout, and about half way between the latter, and the angle of the mouth. Eyes rather nearer to a line raised from the angle of the mouth than to the nostrils; pupil circular and small; postocular spiracle scarcely visible. Gape wide and arched, having at each corner a triangular fold of skin formed by the union of the upper and lower lips. Teeth regularly placed upon each jaw, only one row in use at a time, the rest reclined; they are large, compressed, and somewhat quadrangular, the cutting edges nearly horizontal, and both of their sides are generally bicuspidate, as will be seen by the figures here inserted, representing from young and old specimens the teeth of both jaws as opposed to each other.



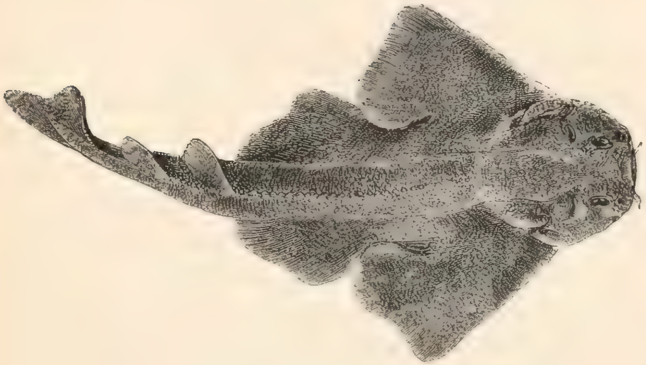


Branchial openings all in front of pectoral fins; the first not more than half the length of the fifth. Pectoral fins rather small, the hinder edges nearly square; the dorsal fins are small, the first narrower at its base than at its extremity, which is slightly rounded; the second nearly throughout of equal breadth, the hinder edge almost square; the ventral fins short, broader behind than at their bases, and their posterior edges slightly undulated; the caudal fin entire, somewhat triangular, and slightly falciform; the upper portion high above the line of the back, the lower scarcely below the line of the body immediately in front of it. Lateral line distinct, commencing above the branchial openings, and extending nearly without curve or undulation to the commencement of the caudal fin, from thence it ascends the latter, and extends along it, nearer to its anterior than posterior edge, until it reaches its upper extremity; at its origin this line is nearer to the middle of the back than the base of the pectoral fin; to the touch it feels slightly rough, which arises from its being beset with a number of minute prickles, which are most distinctly seen in preserved specimens. The surface of the skin both on the body and fins is more or less sprinkled with strong bony-looking spines, with large circular and flattened bases, which are striated from the centre towards the circumference. These spines vary in size as well as form, some being hooked, others quite straight; in some places they are disposed in clusters, in others they are solitary, and on the extremity of the muzzle are nearly wanting. The appendages to the ventral fins in the male seldom extend much beyond their posterior margins.

According to M. Risso, the females of this species have a smaller number of these spines than the males.



CHONDROPTERYGII. *SQUALIDÆ.*



THE ANGEL FISH.

MONK-FISH, SHARK-RAY, *and* KINGSTON.

Squatina angelus, DUMERIL. CUVIER, Règne An. t. ii. p. 394.
,, *Monk, or Angel-fish*, WILLUGHBY, p. 79, D. 3.
Squalus squatina, LINNÆUS. BLOCH, pt. iv. pl. 116.
,, ,, *Angel Shark*, PENN. Brit. Zool. vol. iii. p. 130, pl. 15, male.
,, ,, ,, ,, DON. Brit. Fish. pl. 17.
Squatina vulgaris, *Monk-fish*, FLEM. Brit. An. p. 169, sp. 16.
,, *Angelus*, *Angel-fish*, JENYNS, Man. Brit. Vert. p. 507, sp. 197.
,, *vulgaris*, RISSO, Ichth. p. 45.

SQUATINA. *Generic Characters.*—Body very much depressed; head flat, rounded anteriorly; both eyes on the upper surface; temporal orifices large, behind the eyes; mouth at the end of the snout; pectoral fins large, attached anteriorly to the head, the posterior edge free; two dorsal fins, both behind the ventrals; no anal fin.

THIS fish, certainly more remarkable for the singularity of its form than for its beauty, is called Angel-fish in England, France, and Italy, and is said to have acquired that name from the extended pectoral fins having the appearance of wings: it is also called Monk-fish, because its rounded head looks as if enveloped in a monk's hood. Mr. Donovan says the form of its body has obtained for it in some places the name of Fiddle-fish; and it is also called Shark-Ray, from its partaking of the characters of both Shark and Ray, though in some respects distinct from either. It is, however, by no means so truly osculant between those families as the exotic genus *Rhinobatus.*

It is most numerous on the southern coast of our island; but is occasionally taken in the Forth, and some other parts of the east coast, particularly about Cromer and Yarmouth. It is common on the coasts of Kent and Sussex, where it is called a Kingston,—a name for it that occurs in Merrett's Pinax. It is also taken in Cornwall; and is recorded as occurring in Ireland on the coasts of Kerry, Waterford, Dublin, and Belfast.

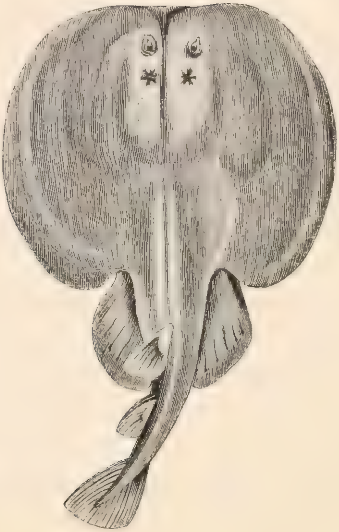
This fish is very voracious, and feeds on the smaller flat-fishes, which, like itself, swim close to the bottom; occasionally, like them also, hiding itself in the loose, soft soil that floats over it. The Angel-fish sometimes attains a large size. Cuvier, Pennant, and others, mention having seen specimens that would have weighed one hundred pounds. The flesh is now considered indifferent and seldom eaten, but is said to have been formerly held in high estimation. The skin is rather rough, and is used for polishing, and other works in the arts: Mr. Donovan also says that the Turks at the present time make shagreen of it.

A second species of this genus has been supposed to occur on our coast; but the Angel-fish is probably liable to some variation in colour, depending on the nature of the ground in the locality in which it is found: the sexes also exhibit some differences. The females produce their young alive in June.

This species is said to attain the length of seven or eight feet; the specimen described measured but fourteen inches;

the breadth of the head in the line of the temporal orifices three inches, whole breadth across the pectoral fins from angle to angle seven inches and a half, breadth across the ventral fins four inches and one quarter; head depressed, rounded at the anterior margin; eyes on the upper surface, distance between them one inch and one quarter; temporal orifices very large, one inch and a half apart, elongated transversely, about as far behind the eyes as these are from the anterior margin of the head: pectoral fins large, lateral, pointed in front, triangular on the outer edge, and rounded posteriorly; sides of the body of the fish parallel behind their free edges; ventral fins elongated, slightly rounded, contracted in breadth behind; commencement of first dorsal fin even with the posterior edge of the ventrals; the second dorsal fin begins at the half of the distance between the commencement of the first dorsal and the caudal fin; tail with an equal-sized triangular lobe above and below. The mouth is very wide, opening on the anterior margin of the head; the angles of the mouth under the external angles of each temporal orifice: teeth long and pointed; branchial apertures elongated; the parallelism of the sides of the fish most conspicuous from below; anal orifice rather before the middle of the whole length; the colour of all the under parts dirty white; the surface smooth; all the upper surface granulated, rough, of a dark mottled chocolate brown; a row of short spines, directed backwards, are ranged along the central line of the back between the ventral fins.

CHONDROPTERYGII. *RAIIDÆ.*[*]



THE OLD BRITISH TORPEDO.

COMMON CRAMP-FISH. NUMB-FISH, *Weymouth.*
ELECTRIC RAY. CRAMP-RAY, *Cornwall.*

Torpedo ———	Cuvier, Règne An. t. ii. p. 369.
,, ———	*Cramp-fish,* Willughby, p. 81, D. 4.
Raia Torpedo,	Linnæus. Bloch, pt. iv. pl. 122.
Torpille,	Duhamel, Sect. ix. pl. 13.
Torpedo,	Walsh, Phil. Trans. 1772, vol. lxiii.
Raia Torpedo,	*Electric Ray,* Penn. Brit. Zool. vol. iii. p. 118, pl.12.
,, ,,	,, ,, Don. Brit. Fish. pl. 53.
Torpedo vulgaris,	*Common Cramp-fish,* Flem. Brit. An. p. 169, sp. 17.
Torpedo marmorata,	Risso, Ichth. p. 20.
,, ,,	Müller & Henle, p. 128.

Torpedo. *Generic Characters.*—The disk of the body nearly circular; pectoral fins large; two dorsal fins placed so far back as to be on the tail; surface of the body smooth; tail short, and rather thick; teeth small and sharp.

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[*] The family of the Rays or Skate.

The earliest notices of this fish on our coasts by English writers were made by Smith in his History of Waterford, and afterwards by Pennant and Walsh; but as, according to Baron Cuvier, several species have been included under the name of the *Raia Torpedo* of Linnæus, the true name of one British species is still doubtful, and it remains therefore for some naturalist who is fortunate enough to obtain British specimens to determine the particular species of our coast.

Colonel Montagu, in his MS. notes, mentions having met with two examples of the Torpedo; but no description of either of them is given. The first was of small size, and was taken at Torcross, where it was so rare as to be unknown to the oldest of the fishermen of that place. Of the second, the notice is as follows:—" I observed a very large specimen that was taken on a turbot-hook off the coast of Tenby, in Wales. It was dead when disengaged from the hook, or the fisherman would certainly have had a shock that would have made him remember the species again. It appeared, however, so rare an occurrence here, that no one knew the fish, which was exhibited as an extraordinary creature. Its weight was about one hundred pounds."

The figure at the head of this subject was taken from a small specimen which appears to be of the same species as that figured by Pennant in the British Zoology; but Pennant's plate, which exhibits in the two outside figures the under and upper surface of a female, the third and middle figure being that of a male of smaller size, appears to have been copied from a larger print representing specimens taken on the sea-shore in the neighbourhood of La Rochelle. Mr. Donovan's figure differs from that of Pennant in exhibiting a marbled appearance on its upper surface, with five distinct dark spots: it differs also in its form and proportions.

The electrical powers of the Torpedo are so well understood by the different names that have been applied to it, as well as by the various and voluminous accounts that have been published, that it is unnecessary to repeat here what has already appeared so often in print elsewhere. The situation of the apparatus or structure from which these species derive their extraordinary power is indicated by the two elevations, one of which is placed on each outside of the eyes and temporal orifices, and extending to the lateral external rounded edges. The apparatus occupies the whole of the space between the upper and under surface of the body, and is composed, as shown by the figures of Walsh and Pennant, of a great number of tubes arranged perpendicular to the plane of the upper and under surfaces, which when exposed by a transverse section have very much the appearance of a portion of honeycomb. The tubes contain a mucous secretion, and the structure is largely provided with nerves derived from the eighth pair. It is said that when the shock is given, the convex part of the upper surface is gradually depressed, the sensation is then felt, and the convexity suddenly returns.

The whole use of the electrical apparatus and power to the fish can only be conjectured. That it serves as a means of defence, is very probable; that it also enables a slow, inactive fish to arrest and obtain as food some of the more active inhabitants of the deep, is also probable. Mr. Couch thinks other powers may be derived from it, and his opinion is thus expressed:—" One well-known effect of the electric shock is to deprive animals killed by it of their organic irritability,* and consequently to render them more readily disposed to pass into a state of decomposition, in which condition the digestive powers more speedily and effectually act upon them. If any creature more than others might seem to require such a preparation of its food, it is the Cramp-Ray, the whole canal of whose intestine is not more than half as long as the stomach."

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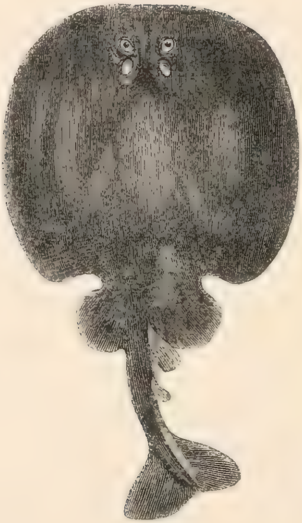
* The bodies of animals killed by lightning do not become stiff, and decomposition goes on rapidly.

"So long ago as the time of Dioscorides, the physician of Anthony and Cleopatra, the shock of this fish was recommended for medical purposes, and especially for pains of the head; and this may be considered as the earliest record of the application of electricity to medicine. In later times, it was applied to the cure of gout; the patient being directed to keep his foot on the fish until the numbness extended to the knees. Baron Humboldt remarks, that the will of the fish directs the effect to whatever part it feels most strongly irritated, but only under the influence of the brain and heart. When a fish was cut through the middle, the fore part of the body alone gave shocks."

But little of its habits are known: it is said to prefer soft and muddy ground, where its actions are slow and inert. It is rare on the British coast; but two or three species inhabit the Mediterranean, and there is reason to believe that two species inhabit our seas. Walsh obtained specimens in Torbay; and the figure of his fish in the Transactions of our Royal Society exhibits the temporal orifices, or spiracles, round and stellated, or having notched or fringed edges. Pennant's figures appear to have been copied from those of Walsh; but Pennant was too good a naturalist to have adopted a figure that did not agree with his specimens; moreover, in his description are the words, "Behind each (eye) was a round spiracle, with six small cutaneous rags on their inner surface." Mr. Donovan's figure exhibits spiracles with fringed edges. The colour was a pale mottled brown. I have assumed, therefore, for distinction's sake, that it may be the *marmorata* of Müller and Henle. The species next to be described has the spiracles oval, with perfectly smooth edges, and has been taken on various parts of our coast.

CHONDROPTERYGII. *RAIIDÆ.*



THE NEW BRITISH TORPEDO.

Torpedo nobiliana,	Bonap. Faun. Ital. fasc. xii. 1835.
,, *Walshii,*	Thompson, Ann. Nat. Hist. vol. v. p. 292.
,, ,,	,, Fauna of Ireland, div. Vertebrata.
,, *emarginata,*	M'Coy, Ann. Nat. Hist. vol. vi. p. 407 ?

In the month of September 1808, H. Hunt, Esq. of Dartmouth, did me the favour to send me two examples of a Torpedo taken on the coast of Devonshire, and these are the only British caught specimens I ever possessed. One of them was very large, and was taken in a trawl-net; this fish I presented in Mr. Hunt's name to the Museum of the Zoological Society, and it is now in the collection: the second specimen being smaller and more manageable, I preserved it for myself, and from it the figure here given was drawn.

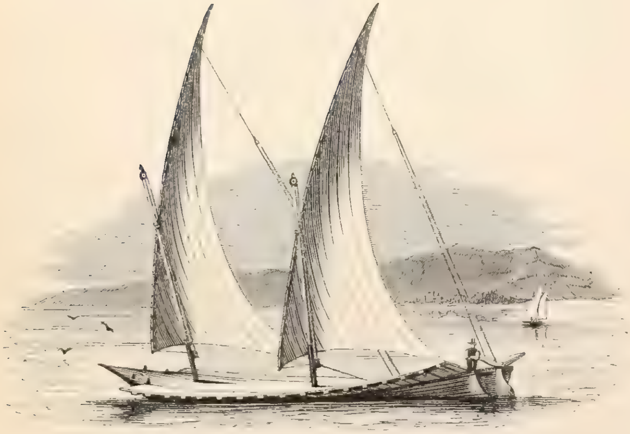
This species differs from the one represented by Walsh, Pennant, Hunter, Shaw, and Donovan, and also that figured by myself in the last engraving, page 542, in having temporal spiracles with perfectly smooth edges: it agrees, moreover, with the Torpedo caught in July 1840 in one of the weirs at Swansea, so minutely described by L. W. Dillwyn, Esq. in his "Contributions towards a History of Swansea." It agrees also with the *Torpedo Walshii* of William Thompson, Esq. who has seen my specimen, and considers it identical with those which have been taken on different parts of the coast of Ireland, most of which are particularly referred to by Mr. Thompson in his paper in the fifth volume of the Annals of Natural History, as already quoted among the synonymes. My specimen is, I believe, identical also with the *Torpedo emarginata* of Mr. M'Coy, as described and figured in the sixth volume of the Annals of Natural History, pages 407 and 408.

When looking over my collection of British Rays with C. L. Bonaparte, Prince of Canino, during his visit to London in May last, that distinguished naturalist, on seeing the Torpedo, immediately said, "that is the *nobiliana* of my Fauna Italica," and I have accordingly placed that name at the head of the synonymes. There is, I think, little doubt that this Mediterranean fish is identical with our new British Torpedo; the figure in the Fauna Italica exhibits the double emargination on the anterior edge at the junction of the pectoral fins with the head, as shown and described by Mr. M'Coy, in his communication to the Annals of Natural History, before referred to; but it does not exhibit the anterior dorsal fin entirely behind the ventrals. In other particulars it agrees with the New British Torpedo, our second species.

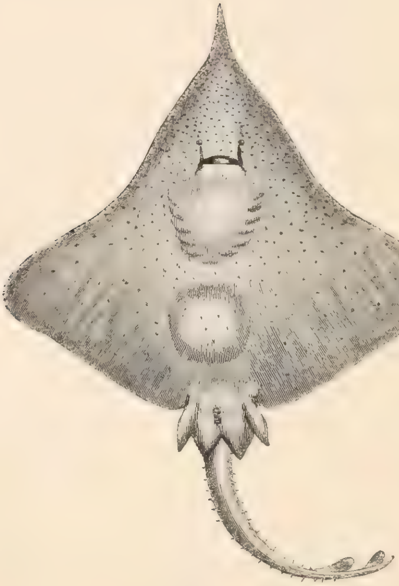
Several specimens of Torpedo, besides those already mentioned, have been taken at various times on different parts of our coast, particularly in Devonshire, Cornwall, South Wales, and the south of Ireland; but their peculiarities were either unnoticed or unrecorded, and it is therefore doubtful to which of our species they belonged. Some naturalists may still consider that we have but one species, and that the present fish is identical with that of Walsh and Pennant. Montagu, unfortunately, did not describe or particularise either of the two specimens he saw, but I think it may be concluded that he would have done so had either of his examples differed from the figure and description given by Pennant. The New British Torpedo appears to vary in its colour from a reddish brown to a dark greenish or bluish black; it remains to be shown whether the smooth uninterrupted margin of the spiracles may be depended upon as a permanent specific character. Excellent descriptions of the new Torpedo have been given by Mr. Dillwyn and Mr. Thompson in the volumes quoted, and a single specimen may decide the question.

The whole length of the fish from which the figure was taken is twenty-six inches; the greatest breadth fifteen inches and a quarter; the length to the posterior free margin of the pectoral fins thirteen inches and a half; the base of the first dorsal fin occupies the central line of the lower third portion of the ventral fins; the second dorsal fin is placed half-way between the posterior edge of the first dorsal fin and the commencement of the upper lobe of the tail; the second dorsal fin is of the same shape, but only half as large as the first dorsal fin; the upper and under lobes of the tail, forming together the caudal fin, are nearly equal in size, and somewhat triangular in shape; the posterior free margin but slightly concave in the centre; the eyes small; the spiracles perfectly smooth at the edge, not in the least serrated, and rather oval in shape than circular, but this form may have been produced while the skin was drying; teeth small, numerous, and pointed, calculated for holding rather than for cutting, the form being that of a sharp incurved spine issuing from a broad base; the mouth wide; the colour on the upper surface of the body and fins a uniform dark chocolate brown tinged with dark bluish black; the under surface white, which, while the fish is fresh, is said by observers to have over it a blush of red. The specimen was a female. The males have long cylindrical appendages to the inner edge of the ventral fins, which in the Rays, or Skate, are called claspers.

The vignette represents a boat of the Lake of Geneva.



CHONDROPTERYGII. *RAIIDÆ.*



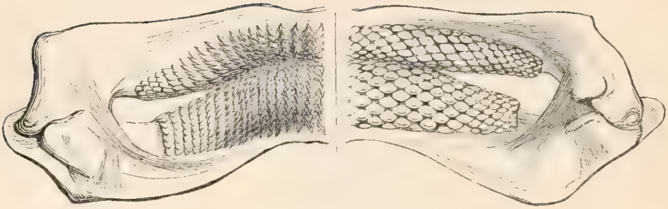
LONG-NOSED SKATE.

Raia mucronata,	*Long-nosed Skate,* Couch's MS.
,, *rostrata,*	Blainv. Faun. Franç. p. 30.
Læviraja oxyrhynchus,	Bonap. Faun. Ital. fasc. xxv.
Raia vomer,	Fries, Ichth. Scand.

Raia. *Generic Characters.*—Form of the body rhomboidal, very much depressed; tail long and slender, generally armed on the upper surface with one or more rows of sharp spines; two small fins near the end of the tail, and sometimes a small terminal or caudal fin; the eyes and temporal orifices on the upper surface of the head; nostrils, mouth, and branchial apertures, beneath; teeth flattened, lozenge-shaped, the inner angle elongated in old males.

The Rays, or Skate, as they are popularly called, are remarkable for the rhomboidal form and consequent breadth of their bodies, contrasted with their long narrow tails, frequently furnished with two and sometimes three small fins, and mostly armed with one or more rows of sharp spines along the whole length. The whole body is very much depressed; the great breadth of it is produced by the expansion of what are considered as the pectoral fins, the base of each of which is equal to the whole length of the side of the fish. The Skate may almost be considered as having no true head or neck, the sides of both being included and thus protected by the expanded anterior margin of each pectoral fin. The nostrils, mouth, branchial and anal apertures, are on the under surface; the eyes and temporal orifices on the upper surface. The texture of the skin of the body varies considerably, and will be referred to when describing the different species. From the peculiar form of the body, admirably adapted to exist at the bottom of the water, the Skate may with more propriety be called a Flatfish than any species of the *Pleuronectidæ.* Their mode of progression is not very easily described: it is, when they are not alarmed, performed with a slight undulating motion of the pectoral fins, something between flying and swimming. I once heard a North-country fisherman call it sluddering. When a Skate makes the best of its way either to gain a prize in the matter of food, or to escape an enemy, great muscular exertion is evident. The mode of defending itself, as described by Mr. Couch, is very effectual: the point of the nose and the base of the tail are bent upwards toward each other; the upper surface of the body being then concave, the tail is lashed about in all directions over it, and the rows of sharp spines frequently inflict severe wounds.

Some sexual peculiarities require particular notice. The woodcut introduced overleaf represents in the left-hand portion an inside view of one-half of the mouth of an adult male; that on the right, an inside view of one-half of the mouth of an equally adult female of the Thornback Ray. While both

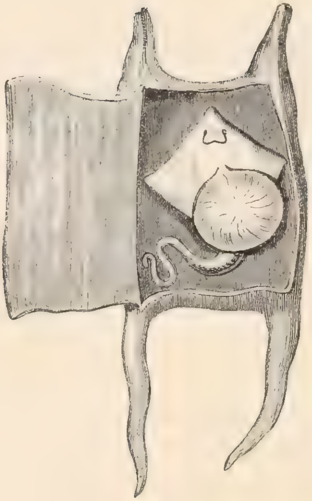


are young, the teeth in both sexes are alike broad and flat; but as the male acquires age and sexual power, the teeth that are nearest the centre begin to alter in form and become pointed, as will be seen on close examination, by an elongation of the internal angle; all the points being directed backwards or towards the throat. Some exceptions to this apparent rule will be pointed out.

Another sexual peculiarity in which the Skate resemble the Sharks is the cylindrical appendage to each ventral fin in the males. The figure at the head of this subject is taken from the under surface of a female, in which no appendages exist; the second figure of the Sharp-nosed Skate, the next in succession, is from the upper surface of an old male, and appendages lying on each side close to the tail may be seen; even in very young specimens, not more than three inches in breadth, the sexes may be determined by the constant existence of these appendages in the males. The fourth figure is taken from the under surface of a young male, and exhibits these appendages of smaller size: their use may be inferred from the name they bear—they are commonly called claspers. The second figure of the Sharp-nosed Ray exhibits also other peculiarities common to males: these are the clusters of spines outside the eye and temporal orifice on each side, and the regular rows of spines towards the upper outer surface of the pectoral fins. The elongation of the central teeth, the development of the cylindrical appendages, and the appearance and growth of the clusters and rows of spines on the upper surface at the parts pointed out, may be considered analogous to those sexual distinctions which exist in many species of birds and mammals, and which have been called by John Hunter and others, secondary sexual characters. These spines on the upper surface of the males occur in the different species of Skate with smooth skins, as well as in the others, and are entirely independent of those spinous productions of the cuticle which distinguish two British species, and will be more particularly noticed hereafter. It may here be stated generally, that the Skate are very voracious: their food consists of any sort of fish that they can catch, with mollusca, testaceous or naked, and crustacea. So powerful are their muscles and jaws, that they are able to crush the strong shell of a crab with ease. As in the Sharks, the females are larger than the males.

The under surface of the Skate at the head of this subject presents two central circular cavities. The upper one just below the transverse mouth is bounded laterally by the five branchial apertures on each outside; within this cavity the gills are placed. The circular cavity below is the abdomen, and contains the stomach, intestines, and other viscera. The heart is placed immediately in the centre between the two cavities, and is protected by a broad and strong transverse cartilaginous arch, the situation of which is indicated.

The young are produced towards the latter part of spring, or during summer. They are deposited by the parent fish in thin horny cases, like those of some of the Sharks already described; but they are more square in form, as the representation here inserted will evince. These horny cases of the Rays, like those of the Sharks, are also called purses; and on the coast of Cumberland bear the name of Skate-barrows, from the resemblance in shape to



a four-handed machine by which two men carry goods. As the young Skate increases in size, the angular parts of the body curve over for a time, till the fish ultimately escapes to provide for itself in a much wider but more dangerous region.

The eleven species of true Rays which are found on the coasts of this country will be arranged here in two divisions; the first of which contains seven species, having the skin perfectly smooth; the second division contains two species with rough skins, and two which are furnished with numerous short sharp spines on various parts of the surface of the body; these lead to three other genera, the species of which are still more powerfully armed with a long spine.

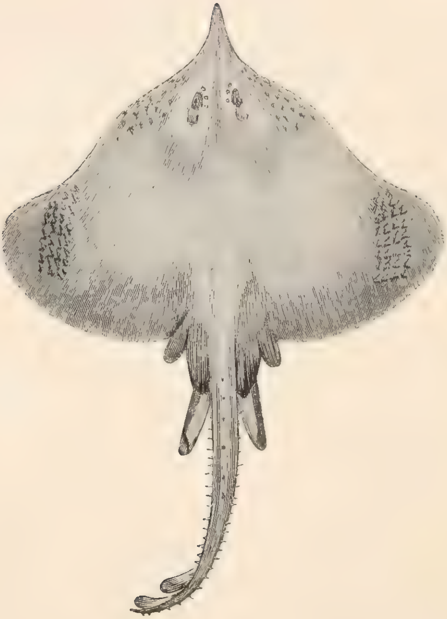
The Skate, as food, are held in very different degrees of estimation in different places. In London, particularly, large quantities are consumed, and the flesh is considered delicate and well-flavoured; but on some parts of the coast, though caught in considerable numbers, both by lines and nets, the flesh is seldom devoted to any purpose beyond that of baiting pots for catching crabs and lobsters.

Skate are in the best condition for the table during autumn and winter. In spring, and in the early part of summer, they are usually maturing eggs or young, and their flesh is then soft and woolly.

The Long-nosed Skate is immediately distinguished from any other Skate found on the British coast, not only by the great length of the nose, but also by the distance between its most extreme point and the transverse line of the mouth; characters particularly observable in comparison with the species next in order, with which it most assimilates in colour. The snout is very much produced, narrow and sharp, slender as far as the eyes, from whence the body dilates gradually to its greatest breadth, which is behind the centre; the whole length of the body and tail one-third longer than the width. On the upper surface the body is of a light lead colour; the tail with a row of crooked spines; the small fins on the tail not far removed from each other, the second about its own length from the end. The under surface is a dirty greyish white, marked with numerous mucous pores which look like dusky specks; the body is thin in substance; the nostrils are lobed; the mouth narrow; the teeth in old males sharp: on the snout two rows of minute tubercular spines; towards the outer upper edge of the pectoral fins on each side are the usual rows of sharp hooked spines, and close to the tail the long pendent claspers. The figure here given represents the under surface of a female.

According to Mr. Couch, this species frequents deep water, and is not caught through the winter: fishermen say that it is exceedingly violent when hooked. I may here state generally, that the greater part of the Skate brought to market are taken in trawl-nets.

CHONDROPTERYGII. *RAIIDÆ.*



THE SHARP-NOSED RAY.

WHITE SKATE, *Scotland.*—BURTON SKATE, *Cornwall.*

Raia oxyrhynchus, Sharp-nosed Ray, MONTAGU, Wern. Mem. vol. ii. p. 423.
,, ,, ,, ,, PENN. Brit. Zool. vol. iii. p. 113.
,, ,, ,, ,, FLEM. Brit. An. p. 171, sp. 21.
,, ,, ,, ,, JENYNS, Man. Brit. Vert. p. 511, sp. 20.
,, ,, *Burton Skate,* COUCH'S MS.
,, *lintea,* FRIES, Ichth. Scand.

THIS species, says Mr. Couch, from whose drawing the figure is taken, "may be easily recognised by its sharp snout, by the waved line of the margin of the body from the snout to the extremity of the expansion, and by its pure white colour on the lower surface. It is the largest of the British Rays; for though in length and breadth it may not exceed the common Skate, its superior thickness renders it heavier."

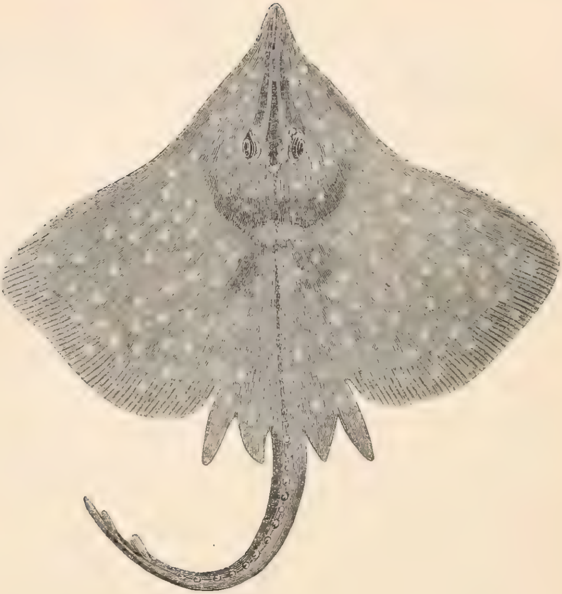
Colonel Montagu, in the Wernerian Memoirs already quoted, says, by way of further distinction, the snout in this species is slender, the lateral margins in a moderately-sized fish running nearly parallel to each other for three or four inches at the extremity. The skin is smooth, with the exception of the spines on the upper surface, peculiar to the males, as shown in the figure; the colour a plain brown without spots or lines, and never so dark as the Skate last described, with which it is sometimes confounded. The teeth of the males, according to a specimen of the mouth very kindly sent to me by Mr. Couch, are longer, more pointed, and sharper than those of any other species I have had an opportunity of examining. The tail is armed with three rows of spines.

Mr. Couch states that the smaller-sized specimens are taken throughout the year; but those which are larger keep in deep water, and are only taken in summer and autumn.

The French are great consumers of Skate, and this species is their favourite fish: their boats come to Plymouth during Lent to purchase Skate, which they preserve fresh and moist during the run back to their own coast by keeping them covered with wet sand.

This species is the White Skate of the Orkneys, and of Scotland generally. Dr. George Johnston says it is not uncommon at Berwick, and attains a very large size: this gentleman had measured one which was seven feet nine inches in length, and eight feet three inches in breadth. It is said to have been taken on the south-east coast of Ireland.

Two examples of this species have been obtained at Madeira by the Rev. R. T. Lowe, as recorded in the Proceedings of the Zoological Society for 1839, p. 92.



THE FLAPPER SKATE.

Raia intermedia. Parnell.

Raia intermedia, *Flapper Skate*, Parnell, R. S. E. Proceedings, 17 April, 1837, p. 166.
,, ,, ,, ,, ,, Trans. R. S. E. vol. xiv. pl. 6.
,, ,, ,, ,, ,, Mem. Wern. Nat. Hist. Soc. vol. vii. p. 429, pl. XL.
,, ,, ,, ,, Muller & Henle, Plag. p. 147.

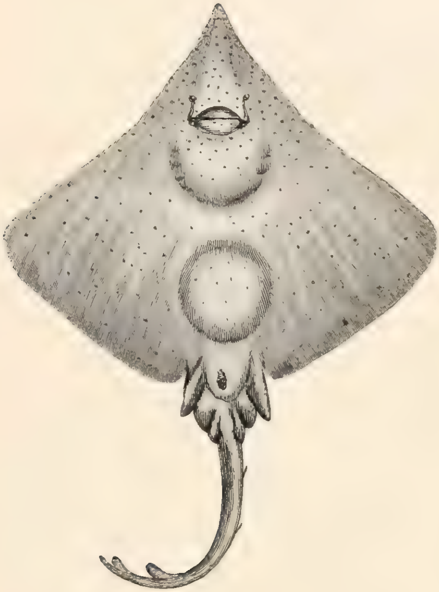
"This fish," says Dr. Parnell, "which was obtained in the Frith of Forth in the month of May, seems to be a new species of Skate, since I am not aware of its having been previously described. It appears to be the connecting link between *Raia batis* and *Raia oxyrhynchus*, to both of which it is closely allied, and it is from this circumstance that I suggest the specific name of *intermedia*."

"It is distinguished from *Raia batis*, in the upper surface of the body being perfectly smooth, without granulations, and of a dark olive colour spotted with white; in the anterior part of each orbit being furnished with a strong spine pointing backwards; in the dorsal fins being more remote from each other, and in the anterior margins of the pectorals being rather more concave, giving the snout a sharper appearance; whereas, in *Raia batis*, the upper surface of the body is rough to the touch, of a uniform dusky grey without spots; the orbits without spines; the dorsal fins nearly approximate, and the anterior margins of the pectorals nearly straight."

"It is likewise removed from *Raia oxyrhynchus*, in the snout being conic; the under surface of the body dark grey; a spine in front of each orbit, and the back of a dark olive-green, spotted with white; whereas in the *Raia oxyrhynchus*, the snout is sharp and long, with the lateral margins parallel near the tip; the under surface of the body pure white, and the back of a plain brown without spots."

This species is not uncommon in the Frith of Forth, and "I have met," observes Dr. Parnell, "with two examples of a variety of this fish which were taken in the salmon-nets at Queensferry. They were both of small size, about eighteen inches in length. The back was of a uniform dark olive green without spots of any description, covered with a thick mucus; under surface of a dark grey; body very thin; snout sharp, conical; pectorals at their anterior margin rather sinuous, passing off somewhat suddenly at that part, in a line with the temporal orifices, giving the outline of the anterior part quite a different appearance to that observed in *Raia intermedia*; the anterior part of each orbit is furnished with a spine; back perfectly smooth; tail with one row of spines on the dorsal ridge; fins, and in all other respects, similar to *Raia intermedia*."

A female specimen of this fish, about two feet in length, tail included, is thus described by Dr. Parnell: — "Body rhomboidal, the transverse diameter equalling the distance between the point of the snout and the last tubercle but three on the central ridge of the tail; from the point of the snout to the temporal orifice, rather more than one-third the length as far as the end of the anal fin, and one-fourth the length as far as the termination of the first dorsal. Body very thin; snout pointed, conical; pectorals large, somewhat of a triangular form, uniting in front at the snout, and terminating at the base of the ventrals; the anterior margin rather concave, the posterior margin rounded; ventrals about three times the length of their breadth; anals commencing close behind the ventrals, and terminating in a free point; rounded at the outer margins. Tail short and firm, being no longer than the distance from the base of the anal fin to the anterior margin of the orbit; along the mesial line is a line of tubercles with sharp points directed downwards, about eighteen in number, commencing at the base of the anal, and terminating at the commencement of the first dorsal fin; no lateral spines visible. First dorsal fin small, rounded at the free extremity; situated about one-third of the length of the tail from the tip; the base of the fin about equalling the length; second dorsal rather smaller than the first, and about the same form, placed about half-way between the termination of the first and the tip of the tail; caudal fin rudimentary. Colour of the upper surface of the body of a dark olive green, with numerous white spots; on the under surface dark grey, with minute specks of a deeper colour. Eyes rather small, flattened above, placed in front of the temporal orifices; skin both above and below perfectly smooth; a strong, sharp, bent spine in front of each orbit; no spine or tubercles of any description on the back. Mouth large, placed beneath; teeth small, not so large or so sharp as those in *Raia batis.*



THE SKATE.

BLUE SKATE, *and* GREY SKATE, *Scotland.*

TINKER, *Lyme Regis.*

Raia batis, Linnæus. Bloch, pt. iii. pl. 79, female.
,, ,, *La Raie cendrée,* Cuvier, Règne An. t. ii. p. 398.
,, *lævis seu cinerea,* Willughby, p. 69, C. 5, male.
,, *batis, The Skate,* Penn. Brit. Zool. vol. iii. p. 111.
,, ,, ,, Flem. Brit. An. p. 171, sp. 24.
,, ,, ,, Jenyns, Man. Brit. Vert. p. 510, sp. 199.
,, ,, ,, Couch's MS.
,, ,, Nilss. and Fries Ichth. Scand.
,, ,, Blainv. Faun. Franç. p. 13.
,, *alba* ,, ,, ,, p. 14.
,, *batis* Bonap. Faun. Ital. fasc. 29.

This species, which is frequently called the True Skate, to distinguish it from the Thornback and Homelyn, which are also popularly called Skate, is not so commonly taken as either, but is still better than either as an article of food.

It appears to be found among the Orkneys, in the Forth, and on the coast of Scotland, where it is called Blue Skate and Grey Skate. From thence southward as far as Kent, and again westward to Cornwall, it is found along the whole line of coast. In Ireland, the Skate is taken from Cork up the east coast to Antrim, and from thence northward and westward to Londonderry and Donegal. At Lyme Regis, on account of its dusky grey colour, it is called the Tinker.

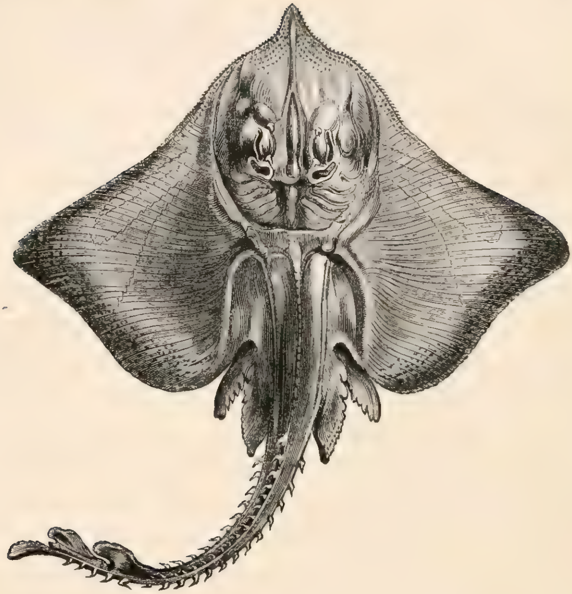
Dr. Storer includes this species in his Report on the Fishes of Massachusetts.

In this species both sexes when adult have sharp teeth, the points beginning to elongate by the time the body of the fish has attained the breadth of twelve or fourteen inches. The females are generally called Maids; and fishermen distinguish the females of the three species of most frequent occurrence by the names of Skate Maid, Thornback Maid, and Homelyn Maid,—frequently calling the old male of the Skate with his two long appendages the Three-tailed Skate. In each of these species the females are observed to be much more numerous as well as larger than the males. Pennant mentions having seen a Skate that weighed two hundred pounds: it is very voracious, and Mr. Couch has known five different species of fish, besides crustacea, taken from the stomach of a single individual. There is reason to believe that the true Skate produces its young later in the season than either the Thornback or the Homelyn.

The breadth of the body is to its length nearly as four to three; the form of the nose conical: the lines from the nose to the extreme lateral angle of each pectoral fin slightly concave; from thence to the ventral fins, the posterior free margins are rather convex; the eyes are slightly elevated above the line of the upper surface of the body, with a short, hard tubercle in the front of each, and a second on the inner side of each; the irides yellow; the temporal orifices valvular, and placed close behind: the dorsal ridge of the body without spines till near the origin of the ventral fins; then commence a single row on the centre, reaching along the tail as far as the first of the two small fins, all the points of the spines directed backwards; one spine between the two small dorsal fins. On the sides of the tail of a female of small size there were no lateral spines; but in a young male of the same size, there were several lateral spines on each side, the points of which were directed forwards, and are in that respect characteristic of this species. The colour of the upper surface of the body and tail greyish-brown: the margins anterior to the angles of the pectoral fins tinged with reddish-brown; those behind the angles brownish-black, darker than the body: the colour on the under surface is sooty white, with dark lines in various directions, and numerous mucous pores looking like blue specks with small sharp points disposed among them over the surface. The nostrils are valvular, half the width of the mouth in advance of each of its angles; the mouth rather wide; the teeth in this species are sharp in both sexes when adult, the inner angles of the central teeth beginning to elongate in specimens when they are about twelve inches in breadth across the body.

I may here add that the true Skate, the subject of the present article, the Long-nosed Skate, the Sharp-nosed Skate, and the Flapper Skate, which precede it, are, in some localities, included under the general term of Skate, from their similarity in colour.

CHONDROPTERYGII. *RAIIDÆ.*



THE BORDERED RAY.

Raia marginata Lacepede.
,, ,, *Bordered Ray,* Flem. Brit. An. p. 172, sp. 27.
,, ,, ,, ,, Jenyns, Man. Brit. Vert. p. 512, sp. 201.
,, ,, Blainv. Faun. Franç. p. 19.
,, ,, Bonap. ,, Ital. fasc. vi.

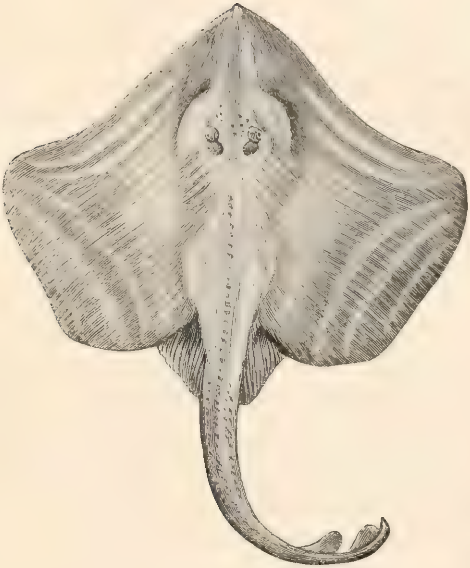
The Bordered Ray, as it is called from the broad dark marginal edge of its pectoral fins, has been taken at Liverpool, Brighton, and Weymouth; it has also been taken at Dieppe, and noticed by M. Noel and Lacépède. It is a well-known species in the Mediterranean, described by M. de Blainville, by the Prince of Musignano, and M. Risso. But little is known of its habits, and it does not attain a large size. M. Risso states that the flesh is considered pretty good.

I avail myself, by permission, of Mr. Jenyns' description of this species, taken from a specimen obtained at Weymouth by Professor Henslow.

" Total length fifteen inches six lines : length of the head from the end of the snout to the spiracles behind the eyes, three inches six lines ; of the tail from the vent to its extremity, seven inches nine lines : greatest breadth across the pectorals, eleven inches three lines. The total length of M. de Blainville's specimen was two feet. The form rhomboidal ; the transverse diameter rather more than one-third greater than the length from the end of the snout to the vent : snout elongated, projecting considerably from between the pectorals, terminating in a sharp point, with the lateral margins nearly parallel for the last quarter of their length : mouth moderately wide ; jaws transverse ; teeth numerous, closely set, in several rows, roundish or somewhat quadrilateral at the base, each terminating in a sharp point : nostrils in a line with the corners of the mouth, and rather more than half-way between them and the upper margins of the pectorals ; a channel from the nostrils to the mouth, covered by a membranous flap : eyes and spiracles both large : skin perfectly smooth above ; and beneath also, excepting along the anterior margins of the pectorals and the surface of the snout, which are set with very minute spines and denticles : one large spine above each eye, inclining backwards, and another smaller one behind each eye : no spines on any part of the back, but three rows on the tail, one occupying the middle ridge, the two others the sides ; the spines on these rows strong and sharp, and mostly inclining backwards : tail scarcely longer than the body, depressed, rather stout, with two moderately-sized finlets of equal form, nearly contiguous ; scarcely the rudiment of a caudal : pectorals broad, with the anterior margins hollowed out, and not prolonged beyond the basal half of the snout; ventrals moderate, deeply notched or bilobated. General colour of the upper part reddish-brown, somewhat paler on the pectorals, with a faint indication of round whitish spots; beneath white, with a broad border all round, especially beneath the angles of the pectorals, of dark reddish-brown, approaching to dusky: tail entirely black."

Since the preceding portion of this article was printed, I have received a specimen of the Bordered Ray from Lyme Regis, for which I am indebted to the kindness of Lord Cole.

The vignette below represents a view taken near Hungerford market.



THE SMALL-EYED RAY,

OR PAINTED RAY.

Raia microcellata,	*Small-eyed Ray,*	MONTAGU, Wern. Mem. vol. ii. p. 430.
,, ,,	,, ,,	FLEM. Brit. An. p. 171, sp. 23.
,, ,,	,, ,,	JENYNS, Man. Brit. Vert. p. 515, sp. 204.
,, ,,	*Painted Ray,*	COUCH'S MS.

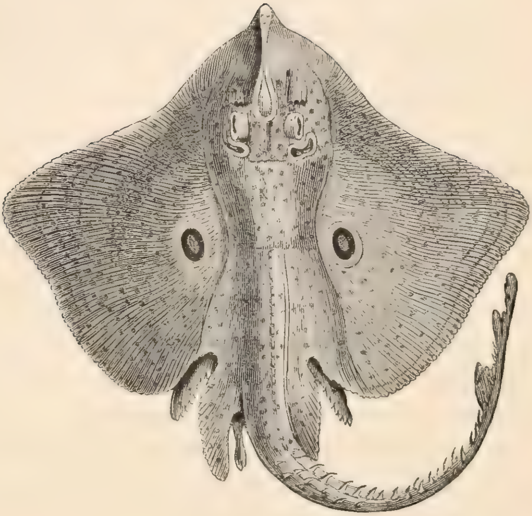
COLONEL MONTAGU and Mr. Couch appear to be the only British naturalists who have obtained this species; and it must be considered a rare one, since the first of these gentlemen saw but two examples, and the latter has only seen one. The very small size of the eye is stated by both to be a remarkable and striking distinction.

The length of the specimen obtained by Mr. Couch was thirty-three inches and a half, of which the tail measured thirteen inches; breadth across the fins twenty-four inches; the eyes three inches apart, and five inches and a half from the snout. The outline of the body much resembles that of the Thornback, ***R.** clavata;* snout a little prominent, the margin waved to the extremity of the expansion, behind rounded; the eyes very small; temporal orifices large: the body covered with rough granulations, but altogether without spines, either on its surface or about the eyes, except a row that runs along two-thirds of the back, and down the middle of the tail to the fins; an irregular row of similar hooked spines extends along each side of the tail; along the tail is a border on each side, like a membranous fin; two rounded fins towards the end of the tail, somewhat separated, the hindmost one inch from the end, with which it is continuous by means of an elevated ridge. In the distribution of its colours this is the most beautiful of the British Rays. The upper surface is a light grey, with a lighter line running along the back and middle of the tail, enclosing the central row of spines. The disk is beautifully and regularly quartered, first by three white lines enclosing each other, and passing from near the eye circularly to near the extremity of the expansion, the convexity of the arch inwards, and consequently the shorter line nearer the margin; on the hinder edge of the disk, formed by the pectorals, are two other lines passing from behind the expansion circularly to the neighbourhood of the abdominal fins, the convexity of the arch inwards; on the more central part of the disk are a few whitish spots, those of both sides answering to each other; the extreme edge of the disk posterior to its greatest expansion, and also the abdominals, as well as the fin-like margin of the tail, are edged with white. The nostrils have a prominent expanded membrane; width of the mouth three inches; teeth flat, like those of the Thornback; mucous orifices on the under surface numerous, and as if punctured with a pin; the colour of the skin a pure white.

Such is the description Mr. Couch gives of his specimen, which was a female, and which was taken by a line on the 28th of January 1835. In it numerous eggs were found, some of which had attained their full growth ;—a circumstance which fixes the period for the production of the young in this species. Mr. Couch writes me word that he has since obtained a second specimen, and Mr. M'Coy has described one in the 6th volume of the Annals of Natural History, that was taken in Dublin Bay, p. 407.

Montagu says both his examples were females, resembling his ***R.** maculata* in form ; Mr. Couch refers to the Thornback for shape : the figure here given is taken from Mr. Couch's drawing, and it will be observed that all three have considerable similarity of outline. A few extracts from Montagu's description will exhibit further resemblance. The proportions by measurement are very nearly alike ; the upper surface pale brown, with a few scattered spots and lines of a lighter colour on the margins of the wings ; the skin covered with minute spines, which make it feel rough : the eyes remarkably small, at once pointing out a material distinction ; those of the specimen described did not exceed half an inch in diameter from the opposite angles of the eyelids ; whereas the ***R.** maculata*, and most others of similar size, have eyes nearly double that diameter : one row of small hooked spines on the tail, continuing along the dorsal ridge to the head. Colonel Montagu's specimens being younger than that obtained and described by Mr. Couch, had not acquired the lateral marginal rows of spines on the tail ; the under part smooth and white ; the teeth obtusely cuneiform, with a broad edge that felt rough to the finger as it was withdrawn from the mouth.

CHONDROPTERYGII. *RAIIDÆ.*



THE HOMELYN RAY.

THE HOME, SAND RAY, AND SPOTTED RAY.

Raia miraletus,	Linnæus.	
,, *maculata,*	*Sand Ray,*	Montagu, Wern. Mem. vol. ii. p. 426.
,, *miraletus,*	*Mirror Ray,*	Don. Brit. Fish. pl. 103.
,, *rubus,*	*Rough Ray,*	,, ,, ,, pl. 20.
,, *oculata,*	*Mirror Ray,*	Flem. Brit. An. p. 172, sp. 26.
,, *maculata,*	*Spotted Ray,*	Jenyns, Man. Brit. Vert. p. 514, sp. 203.
,, ,,	Blainv. Faun. Franç. p. 15.	
,, *asterias,*	,, ,, ,, p. 25.	
,, *miraletus,*	,, ,, ,, p. 27.	
,, ,,	Bonap. Faun. Ital. fasc. iii.	

This smooth-skinned spotted Ray, called *Raia lævis* and Homelyn so long ago as the time of Merrett,[*] and one of our most common species along the line of our southern coast, has not been so well distinguished or so clearly defined by some authors as its obvious characters admit and require. The males, though they have, like the females, a perfectly smooth skin, have also spines about the eyes, rows of small hooks on the upper surface of the pectoral fins, one row of spines along the dorsal ridge, with one on each side a little below the commencement of the dorsal series, and when full-grown, with three rows of strong spines on the tail. Thus extensively armed, the male has been called *rubus :* but those authors who quote as a synonyme the *R. rubus* of Bloch, part iii. pl. 84, have been misled by the German ichthyologist, whose figure proves his fish to have been a male of the Thornback, of which his plate 83 is the female.

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[*] Pinax Rerum Naturalium Britannicarum. London, 1667, p. 185.

The Homelyn of our coast has been best made out and described by Mr. Donovan, Colonel Montagu, and more recently by the Rev. Mr. Jenyns, under the different names here quoted.

This species is liable to some occasional variation in the manner in which the upper surface of the body is spotted; the spots are sometimes numerous, at others sparingly distributed: I have seen it quite free from spots, and have also seen it with only one eye-like spot on each side, not far removed from the line of the back. I have mentioned that the skin, independent of the accessory organs, is quite smooth. These variations have given rise to the different trivial names *miraletus*, *oculata*, *lævis*, and *maculata*, which have been applied to it by different authors, from the appearance of the particular specimens examined.

Colonel Montagu, referring to the *miraletus* and *rubus* of Mr. Donovan, had no doubt that they were both identical with his own *maculata*, since, being a common species on the Devonshire coast, he had ample opportunities of seeing it under its different appearances.

Mr. Donovan has given correct figures both of the Mirror

Ray and of the Homelyn, as quoted, the latter under the trivial term *rubus ;* but he believed with Montagu, that they were not distinct species. Mr. Donovan had noticed two similar eye-like spots on several small examples of the true Skate (*batis*) ; and I possess young specimens of the Thornback (*clavata*) with the same sort of ocellated lateral spots, and have seen many others of the three most common species. Mr. Donovan's remark accords so closely with my own view, that I insert it here in his own words :—

" Although we present this as the ***Raia miraletus*** of Linnæus with perfect confidence, it is not without some hesitation at least that we can offer it as a distinct species. In every respect, except the ocellar spot on the wings, it perfectly agrees with the Homerling Ray, and may possibly prove, on further examination of other specimens, to be only a *lusus*, or remarkable variety of that fish."

The figure given at the head of this subject exhibits the eye-like lateral spots, from the possession of which it has been called *miraletus* and *oculata :* the smoothness of the surface of the skin, and its numerous smaller spots, sufficiently warrant the terms *lævis* and *maculata.* The words *oculata* and *lævis* were combined by some of the older authors, and probably referred to this species.

The Homelyn and the Thornback, which are not very dissimilar in shape, though otherwise perfectly distinct, are the two species most common in the London market : a large proportion of both are taken in the trawl-nets.

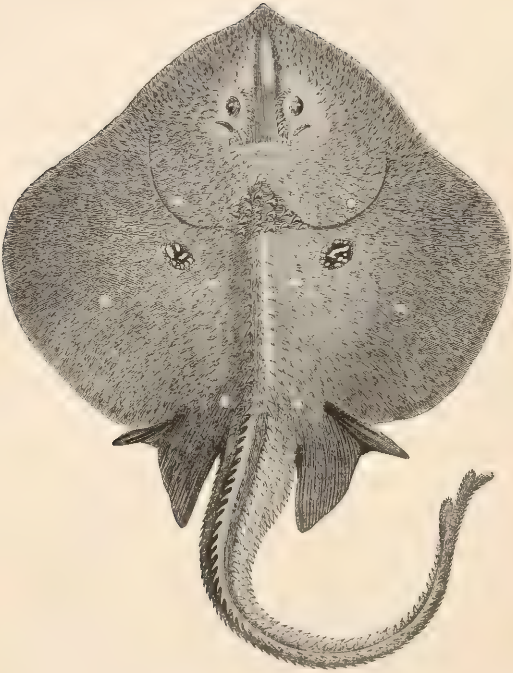
This species is not common on the east coast of Scotland. In Ireland it has been taken at Belfast, Dublin, and Youghal.

The form is rhomboidal ; the diameter of the body about one-fourth greater than the length : the nose short and blunt, its projection beyond the outline of the pectorals but small : in a young male specimen of twelve inches in breadth the secondary sexual characters begin to appear ; there are numerous small spines about the nose, and some extending along part of the anterior edge of the pectoral fins ; two or three prominent spines before and behind each eye, with rough granulations on the surface of the skin before and between them : the more conspicuous characters that distinguish the males have been already noticed. The eyes and temporal orifices are large : the central row of dorsal spines commence above the middle of the body, with one strong spine on each side of it about the middle of the body and in the line of its greatest diameter: the series of spines on the dorsal ridge extend along the centre of the tail, with a row along each side of it in adult specimens ; in young examples the series on each side is not complete. On the tail are two small fins, with two spines between ; the points of all the spines on the central line and on the tail directed backwards.

The colour of the upper surface is a pale yellowish or reddish brown, with spots of darker brown, subject to the variations that have been already pointed out ; the colour of the under surface plain white ; the skin smooth ; nostrils and mouth near the end of the nose ; the mouth transverse, rather small. Montagu says, both sexes of the *maculata* have sharp teeth ; but this refers to examples that are perfectly adult : young males of small size, and females when larger, have the teeth blunt ; in old males, and very probably also in old females, from the operation of those laws which influence the secondary sexual characters, the teeth become pointed.

The term Sand Ray is in some localities applied to the males of this Skate, but that name belongs to the next species.

CHONDROPTERYGII. *RAIIDÆ.*



THE SANDY RAY.

Raia spinosa, Rondeletius, p. 355.
,, *radula*, Delar. Mém. Poiss. Ivic. in An. Must. Hist. Nat. t. xiii. p. 321.
,, ,, *Raie râpe.* Risso, Hist. t. iii. p. 151, sp. 38.
,, ,, ,, *ratissoire*, Blainv. Faun. Franç. p. 25.
,, *circularis*, *The Sandy Ray*, Couch, Mag. Nat. Hist. vol. xi. p. 71.
,, ,, ,, Cornish Fauna, p. 53.
,, *falsavela*, Bonap. Faun. Ital. fasc. xxvi.

In the second volume of the New Series of the Magazine of Natural History, and the eleventh volume of the whole work, Mr. Couch has given a figure and description of a species of Ray, which he hopes will be sufficient to prove that it cannot be confounded with any other Ray recognised as British; " but whether," says Mr. Couch, " it can be referred to any species described by other authors, I am not able to specify, except that I have with some degree of hesitation, supposed it to be possibly the *Raia asterias* of Ray, Syn. Pisc. p. 27.

" I cannot, however, persuade myself but that this species has been described by some authors, to whose writings I have no opportunity of obtaining access; I therefore refrain from assigning to it a trivial name, that I may be in no danger of adding to science a useless synonyme. Its English name of Sandy Ray will be sufficient as a provisional designation."

The close accordance of the figure and description of this fish given by Mr. Couch, to the figure and descriptions of the *Raia radula* of the authors here quoted, leaves little room to doubt but that they refer to the same species, and I include the fish, therefore, as here given, on Mr. Couch's authority. The figure in the Fauna Italica represents a female of our Sandy Ray, with the cluster of central dorsal spines, and the particular form of the ventral or pelvic fins, with other characteristics.

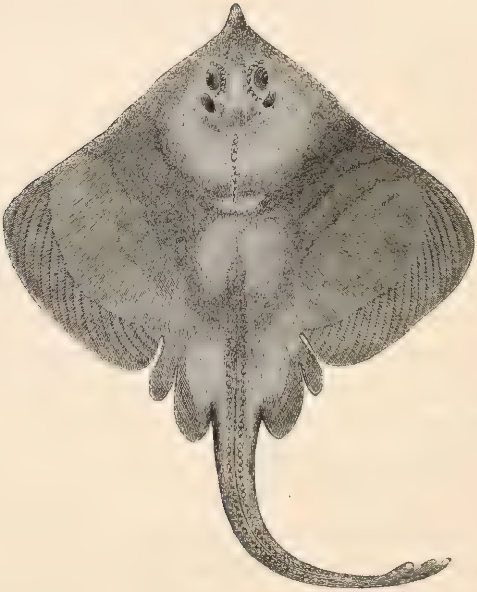
" It bears but a distant resemblance to the *Raia maculata*, or Homelyn," Mr. Couch observes, " either in appearance or value; for while the Homelyn is esteemed as food, either fresh or salted, this is thought worthy only to bait the crab-pot, or, just as frequently, to be thrown aside for manure. It is of frequent occurrence in moderately deep water, from spring to the end of autumn. In winter, however, it is not often seen, chiefly, perhaps, because at that season the boats do not venture quite so far from land; but, perhaps, also, from the fish having changed its quarters. It seems to be an indiscriminate feeder, living on small fishes, and different kinds of crustacea."

"The specimen described, which was of the ordinary size, measured three feet eight inches in length, of which the tail was nineteen inches; the breadth two feet four inches and a half. The snout projected three-quarters of an inch, prominent and elevated; the mouth three inches and a half wide, six inches from the snout. Under jaw peaked in the middle; the teeth slender, sharp, in rows not very closely placed. The body passes off circularly from the snout, the greatest breadth opposite the centre of the disk, and of a rounded form. From the snout the ridge is elevated to the eyes, a distance of five inches and three-quarters; eyes two inches asunder; temporal orifices large. Body thickest posteriorly; the tail stout at its origin, rounded above, tapering; a groove along the body and tail; two fins on the latter close together. A few spines near the end of the snout; a semicircle of them behind each eye; four short parallel rows on the centre of the back, and a middle one continued along the groove to the tail, which is covered with stout hooks, scarcely in regular order. The remainder of the body smooth. Colour above a uniform dusky brown, white below. On the back a variable number of ocellated spots, the size of the section of a large pea; the centre pale yellow, the margin a deeper impression, of the colour of the skin. I have counted from eight to sixteen of these spots in different specimens, and believe they have no determinate number; but they are always placed, on each side, with corresponding regularity.

"Besides this description and figure, which I hope will enable those who visit our fishing vessels to ascertain this species, I will further observe, as marks of distinction from the other British species of this genus, that in addition to the form of the teeth, which are crooked and slender, resembling a bird's claw in miniature, but which still are less long, slender, sharp, or crooked, than in young specimens of the *Raia oxyrhynchus*, it may be distinguished by a great tendency to circularity in the disk, formed chiefly by a rounding off of the pectoral fins, by a flatness of the anterior portion, by the uniformity of its colour, the regularity of the spots, and the comparatively short and tapering tail.

Since the publication of the Supplement to the British Fishes, in which a considerable portion of the previous account appeared, I have been favoured by Captain Portlock, of the Ordnance Survey, with excellent drawings of a male and female of this species, which were caught in the North of Ireland, and from the drawing of the female the representation at the head of this subject was engraved. I am also indebted to Captain Portlock for many other interesting communications on the Natural History of Ireland. The Sandy Ray has also been taken in Dublin Bay. The detailed description by Mr. M'Coy of a Ray without a name, in his paper on some rare fish from the coast of Ireland, printed in the sixth volume of the Annals of Natural History, p. 405, to which I have before had the pleasure to refer, appears to belong to this species.

CHONDROPTERYGII. *RAIIDÆ.*



THE SHAGREEN RAY.

Raia fullonica, Linnæus.			
,,	*chagrinea*,	*Shagreen Ray*,	Montagu, Wern. Mem. vol. ii. p. 420, pl. 21.
,,	,,	,, ,,	Penn. Brit. Zool. vol. iii. p. 117.
,,	*aspera*,	,, ,,	Flem. Brit. An. p. 172.
,,	*chagrinea*,	,, ,,	Jenyns, Brit. Vert. p. 513.
,,	,,	,, ,,	Parnell, Wern. Mem. vol. vii. p. 431, pl. 41.

In the first edition of the History of British Fishes, I made the mistake, from the want of specimens, of confounding the Shagreen Ray of Montagu with the Long-nosed Skate of Mr. Couch. Dr. Parnell very kindly set me right, and sent me, from Edinburgh, for my use, an example of the Shagreen Ray, which appears to be a rare species here in the south; at least I have not as yet been fortunate enough to obtain one.

According to the late M. Fries of Stockholm, the Shagreen Ray of English authors, so called from the rough shark-like texture of the skin, is the *Raia fullonica* of Linnæus, and is probably, though this is not allowed by some writers, the same species as that called *fullonica* by Rondeletius, p. 356 of the Latin edition of 1554, and p. 283 of the French edition, printed at Lyons in 1558, illustrated by figures from the same wood-blocks. This species is also probably the *R. fullonica* of the Danish naturalist, M. Muller.

In the Frith of Forth, according to Dr. Parnell, "The Shagreen Ray is occasionally taken in the stake-nets set in deep water, more especially in the months of May and June, when a few may be seen in the Edinburgh market along with Grey Skate and Thornbacks. It is known to the fishermen under the name of Rough Flapper, and its flesh is considered inferior as food to that of the other species of Skates, it being soft and dry. It feeds on small starfish, and crustaceous animals in general."

Pennant met with a specimen at Scarborough, where he says it is called the French Ray, and that it is caught on hooks baited with sand-eels or sand-launce.

Montagu has noticed it on the Devonshire coast, and mentions having seen several of both sexes, but none larger than that which he has described. He adds, that it is known to some of the west country fishermen by the name of Dun Cow.

The Shagreen Ray has been taken on the north-east coast of Ireland, by the collectors under the directions of the Ordnance Survey; and Mr. Thompson has included this species in his Report to the British Association on the Vertebrata of Ireland, which is published in the volume for the year 1840.

This species appears to be the *Raia aspera* of the Fishes of the Fauna Française by M. Blainville, p. 22.

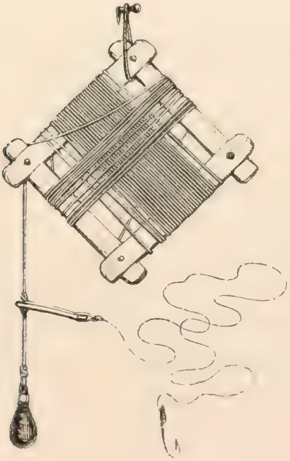
Dr. Parnell's specific characters, and description, from the fish, while fresh, which I hope, on that account, to be excused for making use of, are as follows :—

" Body on the upper surface very rough ; on the under surface of a pure white ; a row of spines round the inner edge of each orbit ; two rows of large bent spines on the tail."

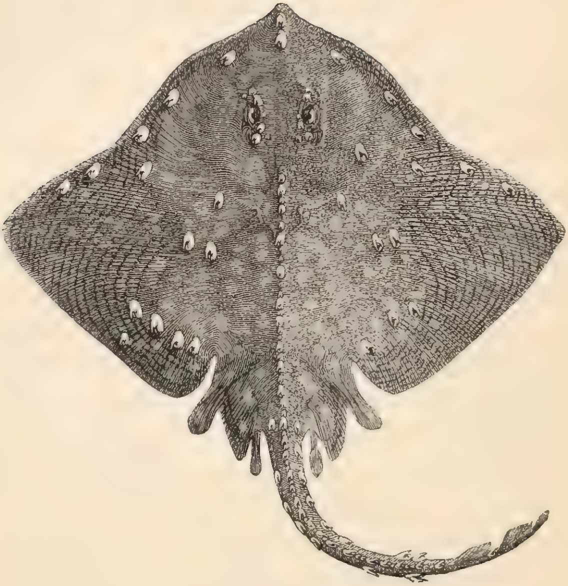
" A female specimen, three feet two inches in length, tail included. Body of a rhomboidal form ; the transverse diameter rather greater than the distance between the tip of the snout and the end of the anal rays ; from the point of the snout to the tip of the pectoral, and from thence to the base of the ventral fin on the opposite side equal ; the length of the tail equal to the distance from its base to the posterior margin of the orbit ; from the tip of the snout to the middle of the eye, one-seventh of the whole length, caudal included ; the transverse cartilage is situated mid-way between the extremity of the nose and the termination of the base of the anal fin. Snout sharp, conate ; the anterior margins of the pectorals slightly sinuous ; the posterior margins rounded ; ventrals narrow, being three or four times longer than their breadth, placed between the termination of the large broad pectorals and the commencement of the anals, composed of five rays, of which the second is the longest. Anals rounded at their outer margins, and terminating free below, about five times the breadth of the ventrals, each furnished with about twenty-one rays. Dorsals approximate, small and thin, situated nearly at the extremity of the tail, both of equal size, rounded at their posterior free margins ; each fin furnished with eight rays, which appear to branch off from one large ray situated horizontally. Caudal fin rudimentary, about half the length of the base of the second dorsal. Colour of the upper surface of the body of a uniform yellowish brown ; under surface pure white. Eyes large ; a temporal orifice situated at the posterior part, and a little on the outer side of each orbit ;

mouth large, placed beneath; teeth strong and sharp-pointed, arranged in each jaw in many rows. Skin on the upper surface very rough, having a granulated feel when the hand is passed over the pectorals; at the base of the ventral and anal fins the skin is perfectly smooth. About six large bent spines, with broad bases situated on the upper part of the snout; round the inner margin of each orbit are from ten to twelve of these spines, arranged in the form of a crescent; on the dorsal ridge, from the nape to the transverse cartilage, is a row of six spines; about a little more than half-way down the back commence two rows of spines, which run down the tail as far as the first dorsal fin; the first ten or twelve spines are very small, the rest gradually increase in size as they proceed; no spines on the central ridge of the tail; each spine has its broad base more or less grooved, and its point directed backwards; on each side of the base of the tail are a number of small hooked spines, placed in two or three irregular rows."

Montagu's figure, in the Memoirs of the Wernerian Society, was taken from an old male; the figure here given is that of a female, carefully reduced from Dr. Parnell's fish.



CHONDROPTERYGII. *RAIIDÆ.*



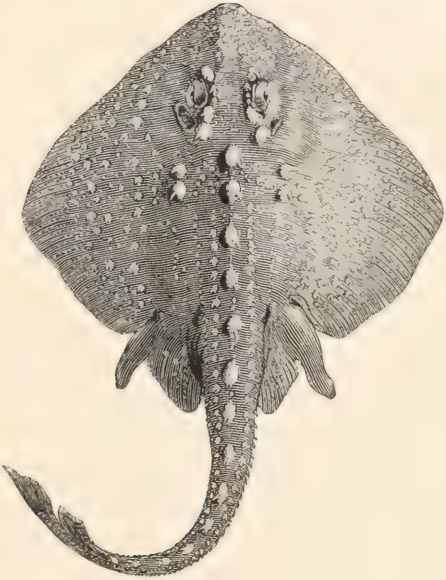
THE THORNBACK.

Raia clavata, Rondeletius.
,, ,, *Thornback,* Willughby, p. 74.
,, ,, Linnæus. Cuvier, Règne An. t. ii. p. 398.
,, ,, *Thornback,* Bloch, pt. iii. pl. 83, female.
,, *rubus,* *Rough Ray,* ,, ,, pl. 84, old male.
,, *clavata,* *Thornback,* Montagu, Wern. Mem. vol. ii. p. 416.
,, ,, ,, Penn. Brit. Zool. vol. iii. p. 122, pl. 14, female.
,, ,, ,, Don. Brit. Fish. pl. 26, female.
,, ,, ,, Flem. Brit. An. p. 170, sp. 19.
,, ,, ,, Jenyns, Man. Brit. Vert. p. 516, sp. 205.
,, ,, ,, Couch's MS.
,, ,, Fries, Scand.
,, ,, *et rubus,* Blainv. Faun. Franç. 33 & 21.
Dasybatis clavata, Bonap. Faun. Ital. fasc. xxix.

The Thornback exhibits very marked distinguishing characters, and being also a very common fish, is one of the best known of the species of Rays,—a term which Mr. Couch considers to be derived from the Anglo-Saxon 'Reoh,' which means 'rough,' and is particularly appropriate to the Thornback, which, on the Cornish coast, is pre-eminently distinguished as the Ray. The Thornback is also taken commonly both on the coast of Scotland and Ireland. From the good quality of the flesh of this fish, and the immense quantity taken every year, the Thornback, and its female, the Maid, is one of the most valuable of the species. Mr. Couch says that the flesh takes salt well, and in this preserved state affords the poor fishermen and their families many wholesome meals when stormy weather prevents them obtaining fresh supplies. The Thornback is taken in the greatest abundance during spring and summer, because the fish then frequent sandy bottoms in shallower water and nearer the shore than usual, for the purpose of depositing their eggs; but the flesh of the Thornback at this season is not, as before noticed, so firm as in autumn and winter. It is in the best condition for table about November. Their food is various other fish, particularly flatfish, testaceous mollusca, and crustacea.

Bloch's figure, plate 83, represents the female of this species, under the name of *R. clavata;* and the fish next in succession in that work, plate 84, is an old male of the same species, but is called *R. rubus*, although most of the synonymes quoted are those of *clavata*.

The figure here given was taken from a young male measuring fourteen inches in breadth. The point of the nose is but little produced: the anterior margins of the pectorals are undulated; the outline behind each lateral angle of the pectorals nearly straight, or slightly rounded: the eyes and temporal orifices rather large, with two or three strong hooked spines both before and behind them. The whole upper surface of the body rough with small points, which when examined with a lens have stellated bases. Besides these, there are distributed over this upper surface numerous nail-like tubercular spines, each of which has an oval osseous base; the margin of the base entire, with a central projecting crooked shank or spine directed backward. Two of these broadly-based spines occupy the central ridge of the nose; others, to the number of thirteen or fourteen, are distributed over each side with some regularity, and similarly disposed on the two sides. The dorsal ridge of unequally-sized spines begins a short distance between and behind the temporal orifices, one or two small spines occurring between each of the larger ones: this single line of spines extends to the origin of the tail, where three rows of spines begin and are continued along it, forming a series of powerful weapons. The tail is furnished with two membranous fins on the upper central ridge, and ends with a small dilatation. The prevailing colour of the upper part is brown, with numerous lighter-coloured spots, and sometimes, as has been noticed already, with one larger rounded spot on each pectoral. Young males and females have fewer spines on the body than old males, and both sexes attain some size before they put forth any; they have frequently also but one row of spines along the tail. The colour of the under side is pure white, with a few spines only on each side. The teeth of the adult male in this species are decidedly different from those of the female, as shown in the woodcut at the top of page 552; those represented on the left hand being from a male fish, and those on the right from a female fish of the same size, and representing one-half of the inside of the mouth of each as seen from behind.



THE STARRY RAY.

Raia radiata, *Starry Ray*, Don. Brit. Fish. pl. 114, female.
,, ,, ,, ,, Flem. Brit. An. p. 170, sp. 20.
,, ,, ,, ,, Jenyns, Man. Brit. Vert. p. 517, sp. 206.
,, ,, Fries, Scand.

This very beautiful and well-marked species was made known by Mr. Donovan in his History of British Fishes, and a very good coloured representation of it is added in that work, which will prevent its being confounded with any other.

Whether this species was really known to other authors their descriptions do not afford unequivocal proof, and I have therefore only quoted those synonymes which I know to refer to this fish. Mr. Donovan's specimen, which was not more than four inches across and seven inches in length, was caught on the north coast of Britain, and was communicated to him by Mr. Stuchbury.

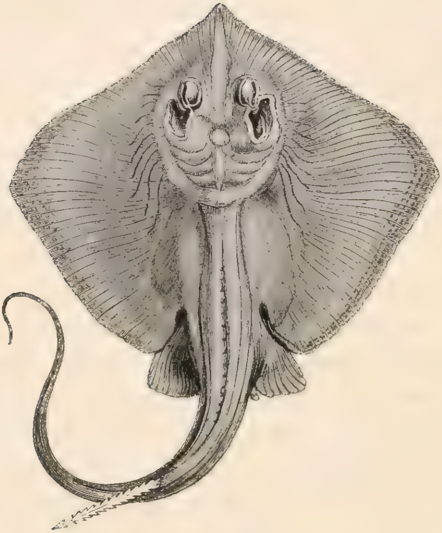
Dr. Fleming, in his History of British Animals, quotes as a synonyme to *radiata* the *R. fullonica* of the Fauna of Greenland, by Fabricius; and it is probably a Northern species, the only three examples of it I have seen having been received, one from Berwick Bay, and two from the Frith of Forth. The first was a female, for which I am indebted to the kindness of Dr. George Johnston, and from this example the figure here given was derived. In 1835, Dr. Parnell sent me from Edinburgh two examples, a male and a female, which had been obtained in the Forth, and obligingly permitted me to retain the male for my own collection, which came marked accordingly. On comparing these three examples with Mr. Donovan's figure, no doubt remained that they were of the same species.

The habits of this fish are but little known, and the figure here given being that of a female, I shall closely describe the male, which was nineteen inches long from the point of the nose to the end of the tail, and fourteen inches in breadth; the snout but little produced, almost falling in with the line of the anterior margin; the lateral expansion of the pectorals and their posterior margins rounded; the pelvic fins rather large: the central ridge of the nose, and a great portion of the pectoral fins or wings, are covered with asperities of different sizes, the forms of which are all alike, being a single spine bent backwards, arising from a stellated base of many radii; these appear to be nearly symmetrical, and about equal in number on the two sides: the eyes are blue and rather large, placed about half-way between the central transverse cartilaginous arch of the body and the end of the snout; before each eye one large spine, and two large spines behind, with several smaller ones along the inner edge of each eye; temporal orifices rather large; one large spine above the line of the transverse cartilaginous arch, one upon the centre of it in the line of the dorsal ridge, and two spines at each lateral extremity of the transverse arch: below this cross-bar commences a series of equally large spines on the dorsal ridge, which extends to the first fin on the tail; between these large spines are a few smaller ones, and on each side the central row of large spines is another row of spines about half the size of the large ones, but more numerous, forming three distinct rows down the back and tail; but all of them, though differing in size, have the same character in respect to the beautifully radiated form of the base from which the ascending spine arises: the upper surface of the body independently of this arming is perfectly smooth; the colour pale brown, with a tinge of orange brown.

On the under surface the colour is uniformly white; the skin soft and smooth; the nostrils large, defended by a cutaneous valve; the mouth rather small; the teeth in the male with the internal angle elongated and sharp, and in a second specimen, a female of ten inches only in length, the teeth are becoming pointed.

The sexual appendages in the male here described are half as long as the tail; and as these, as well as the other sexual distinctions, are well marked in this fish, which only measures fourteen inches in breadth, I am induced to believe, from the early acquisition of these characters, that this species does not attain a very large size. This species is probably the *Raia asteria aspera Rondeletii* of Willughby, p. 73, pl. D, 5, f. 4, and the *Raia aspera* of M. de Blainville, in the *Faun. Franç.;* but I have not included these names among the synonymes at the head of the subject, for the want of that additional certainty which good figures would have supplied.

CHONDROPTERYGII. *RAIIDÆ.*



THE STING RAY.

COMMON TRYGON. FIRE FLAIRE.

Trygon pastinaca,	*La Pastinaque,*	Cuvier, Règne An. t. ii. p. 399.
,, ,,	*Common Trygon,*	Flem. Brit. An. p. 170, sp. 18.
Pastinaca marina,	*Rondeletii,*	Willughby, p. 67, C. 3.
Raia pastinaca,	Linnæus.	Bloch, pt. iii. pl. 82.
,, ,,	*Sting Ray,*	Penn. Brit. Zool. vol. iii. p. 125.
,, ,,	,, ,,	Don. Brit. Fish. pl. 99.
,, ,,	,, ,,	Jenyns, Man. Brit. Vert. p. 518, sp. 207.
,, ,,	Nilss. Ichth. Scand. p. 120.	
,, ,,	Blainv. Faun. Franç. p. 35.	
Trygon pastinaca,	Bonap. ,,	Ital. fasc. 6.

Trygon. *Generic Characters.*—Head enclosed laterally by the pectorals; posterior portion of the disk of the body somewhat rounded; tail armed near its origin with a long and sharp flattened spine, serrated on both edges: the rest of the tail slender, without fins, and ending in a point; teeth small.

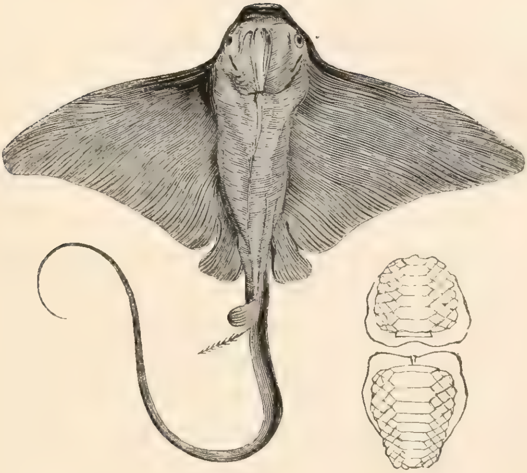
From the Rays whose bodies are more or less covered and protected with sharp spines supported on broad bases, and which spines, continued along the upper surface of the tail, are defensively or offensively used, the transition to those species of Rays which are still more powerfully armed is easy and natural.

The Sting Ray was well known to the ancients, who entertained many curious notions of the power and venom of its spine; and this fish is also noticed as an inhabitant of the shores of this country so long ago as the days of Merrett and Sibbald. Dr. Parnell has obtained one in the Forth. At present it is more frequently taken on the southern coast than elsewhere, from Sussex even as far west as the county of Cork in Ireland. It appears, however, otherwise, to occupy an extensive range, being found in the Mediterranean, and from thence to a high degree of north latitude on the coast of Norway.

Colonel Montagu, in his notes, mentions obtaining a specimen, taken at Hastings, which was presented to him by the Rev. Mr. Whitear. "At the base of the bony process in the tail of this fish, was a smaller one ready to replace the original if by accident it should be lost; or possibly this weapon may be deciduous and occasionally discharged." I have lately obtained two in the London market.

Mr. Couch in his MS. says, "This species keeps on sandy ground at no great distance from land, and in summer wanders into shallow water, where it is often entangled in the fishermen's nets,—the only way in which it is usually caught, for it rarely swallows a bait. The manner in which this fish defends itself, shows its consciousness of the formidable weapon it carries on its tail. When seized or terrified, its habit is to twist its long, slender, and flexible tail round the object of attack, and with the serrated spine tear the surface, lacerating it in a manner calculated to produce violent inflammation." Other authors state that it is capable of striking its weapon with the swiftness of an arrow into its prey or its enemy, when with its winding tail it secures its capture. These spines, as may be supposed, possess no really venomous quality: when lacerated wounds happen to men of a bad habit of body, the symptoms are frequently very severe. In some countries, serrated fish spines, admitting of easy application by tying, are used to point arrows and spears, which when thus mounted become very formidable weapons.

A specimen examined and described by Pennant was two feet nine inches long from the tip of the nose to the end of the tail; to the origin of the tail, one foot three inches: the breadth, one foot eight inches. The body is quite smooth, except, according to M. de Blainville, a few small tubercles along the central line of the back and tail, as well as on the upper and posterior part of the pectoral fins—probably a male fish; the shape almost round, and of a much greater thickness and more elevated form in the middle than any other of the Rays, but grows very thin towards the edges; the nose is very sharp-pointed, but short; the irides are of a gold colour; behind each eye the temporal orifice is very large: the colour of the upper surface of the body is a dirty yellow; the middle part, of an obscure blue: Mr. Donovan says the young are spotted with brown. The tail and spine are dusky; the former very thick at the beginning: the spine, placed at about one-third of the length of the tail from the body, is about five inches long, flat on the top and bottom, very hard, sharp-pointed, the two side edges thin, and closely and sharply serrated the whole way; the tail extends four inches beyond the end of this spine, and becomes very slender at the extremity. The under surface is white; the nasal lobes very large; mouth and teeth small. The flesh is said to be rank and disagreeable, and when laid bare by skinning or cutting into, is very red,—a circumstance which may account for the old name of Fire Flaire.



THE EAGLE RAY.

THE WHIP RAY. MILLER.

Myliobatis aquila,	*Aigle de mer,* Cuvier, Règne An. t. ii. p. 401.
Aquila Bellonii,	Willughby, p. 64, C. 2.
Raia aquila,	Linnæus. Bloch, pt. iii. pl. 81.
,, ,,	*Whip Ray,* Penn. Brit. Zool. vol. iii. p. 128.
,, ,,	,, ,, Jenyns, Man. Brit. Vert. p. 519.
,, ,,	Blainv. Faun. Franç. p. 38.
Myliobatis aquila	Bonap. ,, Ital. fasc. 2.

Myliobatis. *Generic Characters.*—Head partly disengaged from the pectoral fins; teeth flat; the central plates much larger than those which are lateral; pectoral fins wing-like; the tail armed with one fin upon the root, behind that a serrated spine, as in the last genus *Trygon.*

Pennant, in his British Zoology, states that Mr. Travis, surgeon at Scarborough, had the tail of a Ray brought to him by a fisherman of that town: he had taken it in the sea off that coast, but threw away the body. It was above three feet long, entirely covered with hard obtuse tubercles, extremely slender and taper, and destitute of a fin at the end. The tail of a fish received from Sicily, and believed to have been taken from a specimen of the Eagle Ray, which is not uncommon in some parts of the Mediterranean, corresponded with the description given by Mr. Travis.

On this authority the Eagle Ray was admitted into the first edition of the History of British Fishes, in the hope that observers on the coast would be induced to record any new occurrence that might come under their notice. Aware of this, says Dr. George Johnston, in the Proceedings of the Berwickshire Naturalists' Club, for September 1839, "it was, with no ordinary delight, that I received a perfect specimen of the *Raia aquila* on Wednesday last, September 11th, which had been found that morning on the shore of our bay (Berwick) near Spittal. It was quite fresh, and in fine preservation; and proves, as I think, that the conjecture of Mr. Travis's fish being the *aquila* is perfectly correct. There is, at all events, now no doubt that this species is a native of our seas."

The following is Dr. Johnston's description of his specimen. "Body rhomboidal, expanded laterally, flat, thickish, and raised in the middle, which gradually passes into the thin sides or fins, of a uniform dusky olive green colour, smooth and even. Head depressed, with a square vertex, or we may compare it to the figure of a horse's hoof, having an oblong space in the centre that represents the hollow part of the hoof; the front suddenly lowered, round and entire. Eyes lateral, wide apart, roundish, dark grey, overhung by a bony ridge. Behind them there is a large elliptical hole leading to the gills. There is a series of punctures on each side of the head, becoming most distinct and visible on the occiput. Each fin forms a wide triangle, with entire plain margins.

Posterior fins square, and very small proportionably. Tail once and a half as long as the body, flagelliform, tapering to a point, quadrangular, smooth, furnished with a small fin within two inches of its root, and immediately under this fin the aculeus, or sting, is protruded, which is upwards of three inches in length, linear-lanceolate, long, serrated on both sides, the serratures reflected. Ventral surface whitish, duskier at the sides, smooth. Teeth transverse, linear-oblong, with a small open space between the end of every pair on each side."

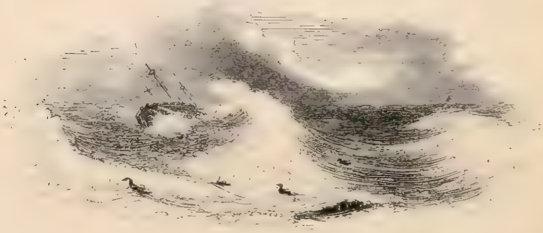
"Extreme breadth twenty-one inches. From the snout to the insertion of the tail thirteen inches. Length of the tail twenty-one inches and a half."

I should be most ungrateful if I did not here record my sincere thanks to Dr. Johnston, whose extreme liberality induced him to present this interesting and unique British specimen to me, and it is now preserved in my collection, containing most of our British Rays.

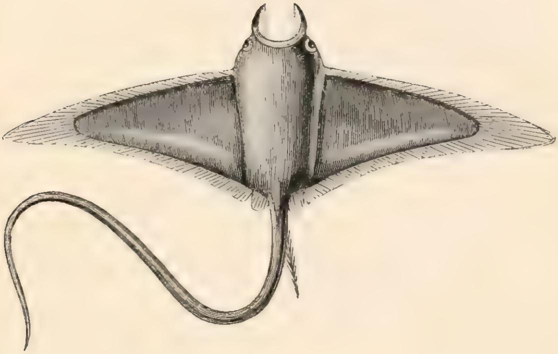
This fish is called Eagle Ray from the wing-like form of the pectoral fins; and Whip Ray, from the long, slender, and flexible character of its tail. The outline near the figure of the fish represents the teeth of the upper and under jaw; each jaw forms part of a circle; and from a particular rolling motion, added to the crushing power of these teeth, the fish has acquired the additional name of the Miller, in this and in some other countries.

The Eagle Ray inhabits the European seas, the Mediterranean, and has been found as far south as the Cape. Bloch says he obtained one from Hamburgh, but it appears to be much more common in the Mediterranean. Risso, in his Ichthyology and Natural History of the environs of Nice, says, that this species is taken throughout the year on the shores of Nice, and is exposed for sale in the markets of Sardinia and Rome: at the former place the spine of the tail is always cut off under a local regulation. The wounds produced by these caudal spines are considered so dangerous that the fishermen cut them off as soon as they get the fish out of the water; Risso, however, says that the common notion that these spines possess venomous qualities is a mistake. Spallanzani and many other observers had satisfied themselves that these serrated spines, when driven with force, penetrating and tearing at the same time, though producing painful wounds, leave no trace of the least poison. Risso further mentions that the Eagle Ray swims rapidly without much action of the pectoral fins; that the flesh is not in great estimation, but that the oil from the liver is considered useful in paralytic affections.

I find this species, the one last described, the Sting Ray, a Torpedo, and four other species of Rays, included in a catalogue of one hundred and thirty-seven different kinds of fish, of Malta and Gozo, with their Maltese, Latin, Italian, English, and French names, as well as their season, by Gaetano Trapani, first clerk in the Office of the Magistrate for the markets, printed at the Government Press, Malta, 1838. For a copy of this very useful little book I am indebted to the kindness of Mrs. Sarah Austin, a sister of Richard Taylor, Esq.



CHONDROPTERYGII. *RAIIDÆ.*



THE HORNED RAY.

Cephaloptera Giorna,	Risso, Ichth. p. 14.
,, ,,	,, Hist. p. 163.
,, ,,	Cuvier, Règne An. t. ii. p. 401.
Raia mobular,	Blainv. Faun. Franç. p. 41.
Cephaloptera Giorna,	Thompson, Report Brit. Assoc. 1840, p. 399 & 409.

Cephaloptera. *Generic Characters.*—Body depressed; head truncated in front; on each side of the head a membrane rolled upon itself, extended, in form like a pointed horn; eyes large, lateral; mouth transverse; teeth small, like a file; the other characters as in the genus *Trygon.*

To William Thompson, Esq. of Belfast, one of the Vice-Presidents of the Natural History Society of that town, I am indebted for many valuable and interesting notices of the fishes of the Irish lakes and coast which are distributed in various parts of this work. In 1835, Mr. Thompson made the following communication to the Zoological Society of London, which is published in the Proceedings for that year, at page 78.

" *Cephaloptera*, Dumeril.—A fish of this singular genus, taken about five years ago on the southern coast of Ireland, and thence sent to the Royal Society of Dublin, is at present preserved in their museum. In breadth it is about forty-five inches. The specimen being imperfect, and the characters of some of the species being ill-defined, I hesitate applying to it a specific name. It somewhat resembles the *Cephaloptera giorna* as figured by M. Risso."

It is most probable that it is this fish, since the *C. giorna* is the only species of the genus as yet known to exist in the European seas. I am aware that M. Risso considers that he has found a second species in the vicinity of Nice ; but several good authorities believe that his examples of *Cephaloptera Massena* are only old and large specimens of *Cephaloptera giorna.*

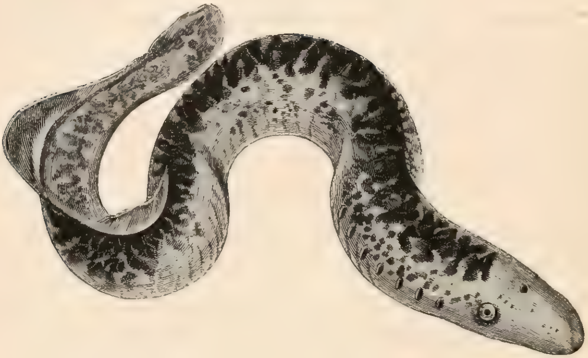
The Horned Ray, differing greatly in size, appears to have come often under the observation of M. Risso at Nice ; and the following remarks, in reference to its Natural History, are derived from his published works.

This fish approaches the shore, and is most frequently taken in the month of July. From their horned appearance, small ones are called *vachetta*,—young cow ; the larger ones *vacha.* When found in pairs, the males appear to have a strong attachment to the females. M. Risso relates that a female was taken in one of the divisions or chambers of a net arranged to catch Tunnies : the male constantly remained in the vicinity for two days, from time to time approaching and wandering round the net, as if in search of the female. Two days afterwards he was found dead in the same division of the net which had proved the fatal prison of his companion. The young come forth in September, having been previously deposited by the mother in long yellowish eggs. Their food consists principally of cephalapods and fishes. Their liver is large, and produces abundance of oil ; their stomach and intestines exhibit numerous plicæ. Contrary to that which is observed in cartilaginous fishes generally, which are remarkably tenacious of life, the Horned Ray dies immediately on being taken out of the water, and even if confined by a rope tied over the pectoral fins, though allowed to remain in the sea, it dies in a few hours. The flesh is red, dense, hard, difficult of digestion, and not in esteem as food, but is eaten by the poorer classes. Females are larger and darker in colour than males. They grow to an almost incredible size. M. Risso saw a male that weighed eight hundred pounds, and a female that weighed twelve hundred pounds. In the Arcana of Science and Art for the year 1834, page 224, is a description and a figure representing this fish, copied from M. Le Vaillant. He saw three in lat. 10° 15′ N.; longitude 335° W.; he prevailed upon the crew to attempt the capture of one of them, which they effected, and took the smallest, which measured twenty-eight feet in width, and twenty-one feet in length, and was supposed to weigh a ton (twenty hundred weight); the mouth like a Ray's mouth, but wide enough to swallow a man. The name was applied to it by Lacépède in compliment to the late Professor Giorna, of the Academy of Turin.

The description of M. Risso is as follows:

“The body is thick, and slightly rounded, transversely elliptical, smooth, of an indigo-blue colour above, dingy white underneath; the mouth is of great size; the jaws large; the eyes globular, the irides bluish silver; the spiracles elongated; the branchial openings slightly crescentic; the dorsal fin small, triangular, dark blue, varied with white at the edge; the ventrals short, with a small appendage; the tail is long, thin, and slender, smooth for one-fourth of its length, then tuberculated, and armed at its base with a long and sharp flattened spine, serrated on both edges.

CHONDROPTERYGII. *PETROMYZIDÆ.*[*]



THE LAMPREY.

Petromyzon marinus,	Linnæus. Bloch, pt. iii. pl. 77.
,, ,,	*La Grande Lamproye,* Cuvier, Règne An. t. ii. p. 404.
Lampetra Rondeletii,	Willughby, p. 105, G. 2, f. 2.
Petromyzon marinus,	*Sea Lamprey,* Penn. Brit. Zool. vol. iii. p. 102, pl. 10.
,, ,,	*Spotted Lamprey,* Don. Brit. Fish. pl. 81.
,, ,,	*Lamprey,* Flem. Brit. An. p. 163, sp. 1.
,, ,,	*Sea Lamprey,* Jenyns, Man. Brit. Vert. p. 520, sp. 209.

Petromyzon. *Generic Characters.*—Body smooth, elongated, cylindrical, like that of an Eel; the head rounded; the mouth circular, armed with hard tooth-like processes; the lip forming a continuous circle round the mouth; seven apertures on each side of the neck, leading to seven branchial cells; no pectoral or ventral fins; the skin towards the tail extending in a fold from the body both above and below, forms dorsal, anal, and caudal fins.

The last family of the cartilaginous or chondropterygian fishes contains the Lampreys, and some cylindrical fishes very closely allied to them. These fishes are, in reference to their skeleton, and in some other respects, the lowest in the scale of organization among vertebrated animals. The form and peculiarities of the mouth will be best understood by a reference to the vignette; the figure on the left hand of which shows the flexible lip concealing the mouth; the figure on the right hand represents the rounded mouth, the small and numerous tubercular teeth, and the central aperture leading by the throat to the stomach.

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[*] The family of the Lampreys.

The situation of the branchial cells, and the gills or branchiæ within these cells as they exist in the common River Lamprey, or Lampern, as it is also called, are shown in the right-hand figure at the bottom of page 433: and the water obtains access and egress by seven small apertures on each side of the neck, by the mouth of the fish, or by an aperture through the upper part of the head which communicates with the pharynx, and which communication is distinctly seen in a divided head.

The Lampreys, like the Sharks and Rays, have no swimming-bladder; and being also without pectoral fins are usually seen near the bottom. To save themselves from the constant muscular exertion which would be necessary to prevent them being carried along by the current of the water, they attach themselves by the mouth to stones or rocks, and were in consequence called *Petromyzon*, or Stone-sucker; while the circular form of the mouth induced the name of *Cyclostomes*, or Round-mouthed Fishes, which was bestowed upon them by M. Dumeril.

In reference to the respiratory apparatus in the species of this genus, Mr. Owen has remarked,* that "when the Lamprey is firmly attached, as is commonly the case, to foreign bodies by means of its suctorial mouth, it is obvious that no water can pass by that aperture from the pharynx to the gills; it is therefore alternately received and expelled by the external apertures. If a Lamprey, while so attached to the side of a vessel, be held with one series of apertures out of the water, the respiratory currents are seen to enter by the submerged orifices, and, after traversing the corresponding sacs and the pharynx, to pass through the opposite branchiæ, and to be forcibly ejected therefrom by the exposed orifices. The same mode of respiration must take place in the Mixine," (a species of this family to be described hereafter,) "while its head is buried in the flesh of its prey. The cyclostomous fishes thus present an obvious affinity to the *Cephalopoda*, inasmuch as the branchial currents are independent of the actions of the parts concerned in deglutition."

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* Descriptive and Illustrated Catalogue of the Physiological Series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London, vol. ii. page 80.

The intestinal canal is small, and extends in a straight line along the abdomen to the anal aperture without any convolution. The Lampreys are oviparous, spawning late in the spring; the roe escaping, in both sexes, by a small membranous sheath, which has internally at its base five apertures, one leading upward to the intestine, one to each kidney, and one to each lateral cavity of the abdomen.

The Marine Lamprey, which from its mottled appearance was called *P. maculosus* by Artedi, has a very extensive geographical range. It is found in the Mediterranean, and from thence northwards in most of the rivers of Europe as far as Scandinavia, during the spring. Professor Reinhardt includes it among the fishes of Iceland, and our countryman Pennant gives it a place in his Arctic Zoology. From a description and figure in the Natural History of the Fishes of Massachusets, by Dr. Smith of Boston, this fish appears to be common in the rivers of North America, attaining a large size in those of the more southern states, but not exceeding seventeen or twenty inches in length in a high northern latitude. Dr. Mitchell also includes this species among his fishes of New York. Dr. Storer of Boston, however, considers this fish distinct from the European Lamprey, and calls it the *P. Americanus* of Le Sueur. Our fish is rather common during spring and summer in some of the rivers on the southern coast of England, particularly the Severn, and is found in smaller numbers in several of the rivers of Scotland and Ireland about the same period of the year.

I have received specimens of large size from the Severn in April and May, during which months it ascends that river to a great distance from the sea for the purpose of depositing its spawn. At this time it is considered in perfection as food, and considerable quantities are prepared in various ways for the table : the potted Lampreys and Lamperns of Worcester are in high estimation. A few are caught in the Thames almost every year, up which river it travels notwithstanding all the numerous and various obstacles which the port of London presents. I am indebted to my friend Mr. Broderip for a note of one taken in June 1834, and another in the same month of 1835, as high up the Thames as Sunbury Weir. A fisherman saw the Lamprey, and struck at it with his punt pole, and supposed he hit it, as the fish rose to the surface and was taken as it was swimming along. The haunt of this Marine Lamprey at Sunbury is a little above the church, and nearly opposite the vicarage, in a place called the Church Deep.

In Scotland, the appearance of the Lamprey in the fresh water is rather later in the year than in the rivers of the south. Sir William Jardine says, " They ascend our rivers to breed about the end of June, and remain until the beginning of August. They are not furnished with any elongation of the jaw, afforded to most of our fresh-water fish, to form the receiving furrows at this important season ; but the want is supplied by their sucker-like mouth, by which they individually remove each stone. Their power is immense. Stones of a very large size are transported, and a large furrow is soon formed. The *P. marinus* remain in pairs, two on each spawning place; and while there employed, retain themselves affixed by the mouth to a large stone."

After the spawning season is over, the flesh of the Lamprey, like that of other fish, loses for a time its firmness and other good qualities, and the weakened fish makes its way back to the sea, to recruit its wasted condition.

The food of the Lamprey consists generally of any soft animal matter; and in the sea it is known to attack other fishes even of large size, by fastening upon them, and with its numerous small rasp-like teeth eating away the soft parts down to the bone. It is not very often caught while it remains at sea.

This species usually measures from twenty to twenty-eight inches in length; the head is rounded; the form of the body long and cylindrical, slightly compressed towards the tail; on the top of the head, rather before and between the eyes, is an external aperture, which if examined with a blunt probe is found to pass downward and backward, opening into a tube on a line with the internal orifice of the first branchial sac: along each outside of the neck are seven rounded apertures, leading to as many branchial cells lined with a membrane constructed like that of the gills in fishes; each of these cells has an internal opening into a tube which is closed by a cartilaginous pericardium at the bottom, but communicates upwards with the mouth: the lips surrounding the mouth, and the numerous small teeth within, have been already referred to: on the lower third portion of the body are two distinct membranous dorsal fins, the second of which is the most elevated, the edges of both convex; a continuation of this membrane round the extreme fleshy portion of the tail forms a caudal fin, and a narrow slip passing upwards on the under side forms an anal fin.

The skin is perfectly smooth; the colour of the body olive brown, mottled and spotted on the back and sides with darker green and dark brown; the margins of the fins inclining to reddish-brown; the irides golden yellow.

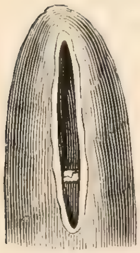
In slowly-running water, the Lamprey swims with a lateral undulating motion of the body, assisted by its dorsal and caudal fins: where the current is rapid, it makes successive plunges forward, attaching itself quickly to any fixed substance that offers to secure the advantage gained.

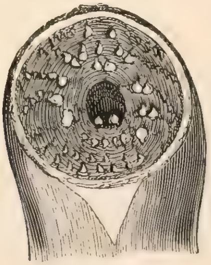
The figure of the fish at the head of this subject was taken from an excellent drawing made by Mrs. Ley.

Dr. Parnell says that in the Forth, above Alloa, when the fishermen take the Lamprey in their nets, they invariably return them again to the water, having a prejudice against them. They are consequently never, under any circumstances, seen in the Edinburgh markets.

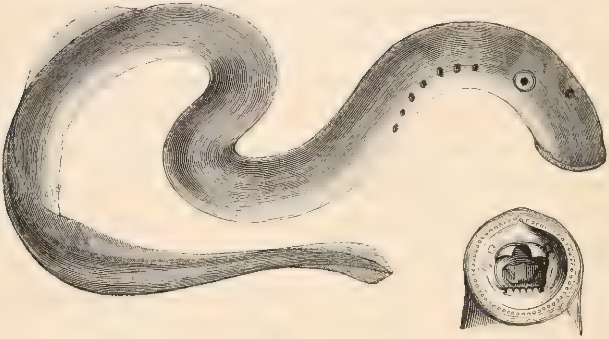
Pennant states that it has been an old custom for the city of Gloucester annually to present the Sovereign of the realm with a Lamprey pie, covered with a large raised crust.

Of this species in Cornwall, Mr. Couch, in his Fauna, says, "Common, but rarely used as food."





CHONDROPTERYGII. *PETROMYZIDÆ.*



THE LAMPERN, OR RIVER LAMPREY.

Petromyzon fluviatilis, LINNÆUS. BLOCH, pt. iii. pl. 78, fig. 1.
,, ,, CUVIER, Règne An. t. ii. p. 404.
,, ,, *Lesser Lamprey,* PENN. Brit. Zool. vol. iii. p. 106, pl. 10.
,, ,, *Lampern,* DON. Brit. Fish. pl. 80.
,, ,, *River Lamprey,* FLEM. Brit. An. p. 163, sp. 2.
,, ,, ,, ,, JENYNS, Man. Brit. Vert. p. 521, sp. 210.

THE RIVER LAMPREY, or Lampern, as it is called by fishermen for distinction, is a well-known species which abounds in many rivers of England, particularly the Thames, the Severn, and the Dee: it is also said to be abundant in the Tweed, in several rivers of Scotland, and on the north, the east, and the south in Ireland.

Some authors state that this species, like that last described, visits our rivers in spring, and returns to the sea after spawning; but the recorded opinions of others, and my own observations, induce me to believe that it generally remains all the year in the fresh water. In the Thames I am certain it is to be obtained every month in the year; but is considered in the best condition for the table from October to March, during which time it is permitted to be caught, according to the rules adopted for the conservation of the fishery.

Formerly the Lampern was considered a fish of considerable importance. It was taken in great quantities in the Thames from Battersea Reach to Taplow Mills, and was sold to the Dutch as bait for the Turbot, Cod, and other fisheries. Four hundred thousand have been sold in one season for this purpose, at the rate of forty shillings per thousand. From five pounds to eight pounds the thousand have been given; but a comparative scarcity of late years, and consequent increase in price, has obliged the line fishermen to adopt other substances for bait. Formerly the Thames alone supplied from one million to twelve hundred thousand Lamperns annually. They are very tenacious of life, and the Dutch fishermen managed to keep them alive at sea for many weeks.

If this species, which is very easily obtained, be examined in the months of March or April, the distinction of the sexes will be immediately evident on opening them. The female may generally be known externally by the larger size of the abdomen, and the male by his lips being more tumid and the mouth larger than that of the female. The season of spawning is May, and the process has been described by several observers. This sometimes takes place in pairs only, and at others by many of both sexes occupying one general spawning bed.

The food of this species, according to Bloch, is insects, worms, small fish, and the flesh of dead fish.

The adult fish is usually from twelve to fifteen inches in length; the body rather slender, cylindrical for two-thirds of its length, then compressed to the end of the tail; the head rounded, with a single aperture on the crown, leading to the tube between the cells, as in the other species: the eye rather large; the seven lateral openings ranged in a line behind, but a little obliquely and below it, on each side: the lip surrounding the mouth has a continuous row of small points on its margin; the mouth and teeth as represented near the figure of the fish: the back furnished with two rather elongated dorsal fins, with a separation between them; the tail furnished with an extension of the membrane above and below.

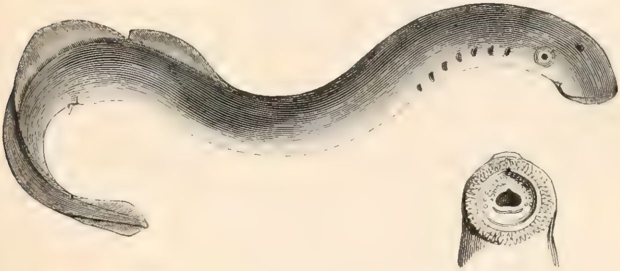
The skin is quite smooth, of a blue colour on the back and sides, passing into silvery white underneath.

In "The Treatyse of Fysshynge wyth an Angle," attributed to Dame Juliana Berners, and first printed by Wynkyn de Worde, in his edition of the Book of St. Albans, in 1496, the learned lady, after recommending a minnow and a worm as proper baits for the Trout in the month of March, adds, "In Aprill take the same baytes: and also Juneba, other wyse named VII. eyes."

Seven eyes and nine eyes, in reference to the apertures about the head, are common names for the Lamprey in this and some other countries; but a derivation for the term Juneba is a desideratum.

Linnæus, in his Tour in Lapland, particularly notices this species, vol. ii. p. 196, as found in West Bothnia, and describes the modes by which they are caught,—namely, hollow cylinders of wood, and elongated wicker-baskets, like those in use in this country for catching Eels. These, he says, "are laid at the depth of two ells in the river, and kept down with stones, the opening being turned to meet the current."

This species is also said to be found at Moscow, and in the Black and the Caspian Seas.



THE FRINGED-LIPPED LAMPERN.

PLANER'S LAMPREY.

Petromyzon Planeri, Planer's Lamprey, BLOCH, pt. iii. pl. 78, fig. 3.
,, ,, *La Petite Lamproye,* CUVIER, Règne An. t. ii. p. 404.
,, ,, *Planer's Lamprey,* JENYNS, Man. Br. Vert. p. 522, sp. 211.

THIS species, when adult, is easily distinguished from the Lampern last described, by its being much shorter in length, and yet equally thick in substance: it may also be recognised at all ages, on comparison with it, by its having the whole broad edge of the circular lip furnished with numerous papillæ forming a thickly-set fringe, and by the depth and close connexion of the two dorsal fins.

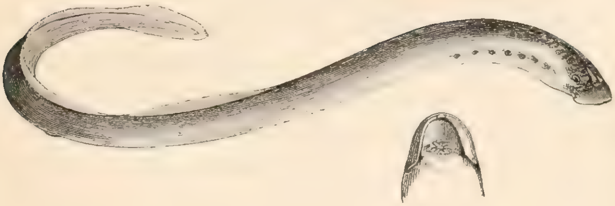
Dr. Parnell says, this species is found in the Forth, the Teeth, the Allan, and several other rivers in Scotland. I am indebted to the kindness of Sir William Jardine for two specimens of the young of this species, which were sent from the Tweed. Dr. Johnston has been told that it is not uncommon at Melrose. I have received some from Surrey, and Mr. Linwood mentions having found some in Sussex. Mr. Couch has obtained specimens from a branch of the Looe, in Cornwall. I have received some specimens from Lancashire, the males of which measured eight inches in length, and the females nine inches. Mr. William Thompson, in his Fauna, records this species as having been taken in the north, east, and south of Ireland.

This species was named by Bloch after his friend Planer, a professor at Erfort, who sent him specimens; but if Bloch's species be the same as our British fish, his figure is exceptionable. This Lampern appears to be well known to M. Nilsson, who includes it in his Prodromus of the Fishes of Scandinavia, and says it is an inhabitant of almost all the brooks and rivers of Sweden, and that it spawns in April or May. M. Nilsson gives to this fish the length of six inches only: it appears therefore that this species, like *P. marinus* and *P. fluviatilis*, does not acquire in high northern regions the size of our specimens in this country.

When compared with *P. fluviatilis*, Planer's Lampern has the orifice on the forehead, the eye, and the first of the branchial apertures, much nearer the anterior edge of the lip than in the other species; the lip broad and fringed, and the disposition of the teeth as shown in the additional figure of the mouth only: the first dorsal fin begins about the middle of the whole length of the fish, and is in close contact with the second dorsal fin, which in its base is as long again as the first: the tail is furnished with an extension of membrane above and below, forming a caudal fin; and a narrow slip passing forwards towards the anal sheath, forms a rudimentary anal fin.

In its colours this species agrees with the common Lampern, being dusky blue on the back and sides, passing into silvery white on the belly, the fins having a brown tint.

In its habits, Planer's Lampern so closely resembles the common Lampern, as frequently, no doubt, to have been mistaken for it. Both may go to the salt or brackish water from that part of a river within the influence of the tide.



THE PRIDE, AND SANDPRIDE.

SANDPREY, AND MUD LAMPREY.

Ammocœtes	*branchialis,*	*Lamprillon,*	Cuvier, Règne An. t. ii. p. 406.
,,	,,	*Pride,*	Flem. Brit. An. p. 164, sp. 3.
,,	,,	,,	Jenyns, Man. Brit. Vert. p. 522, sp. 212.
Petromyzon	,,	Linnæus.	Bloch, pt. iii. pl. 78, fig. 2.
,,	,,	*Pride,*	Penn. Brit. Zool. vol. iii. p. 107, pl. 10.
,,	*cæcus,*	*Mud Lamprey,*	Couch, Loudon's Mag. Nat. Hist. vol. v. p. 23, figs. 9 & 10.

Ammocœtes. *Generic Characters.*—Form of the body, the branchial apertures and fins, like those of the Lampreys; upper lip semicircular, with a straight, transverse under lip; mouth without teeth, but furnished with numerous short membranous cirri.

This small fish is very similar in its general appearance to the young of the Lampreys found in fresh water; but its prominent lip is in the form of a horse-shoe, and the circle not being complete, it has not the power of adhering to stones and other substances like the true Lampreys, but generally hides itself in the mud or loose sandy bottoms of rivers and brooks in this country, in most of which it will be found, but requires close search to detect it. It is of little value, seldom exceeding six or seven inches in length, and is about as thick as a large quill.

It was formerly considered to be a Lamprey, and was called *Petromyzon cæcus* by Ray, on account of its very small eyes: it afterwards had the trivial name of *branchialis* bestowed upon it by Linnæus, from a notion that it attached itself to the gills of fishes. It is said to be common about Oxford, and was called by Dr. Plot, in his History of Oxfordshire, the Pride of the Isis; Prid being an ancient diminutive for Lamprey. It is very common in the Thames about Hampton, where it is called Sandpride. Mr. Jesse says the Eel is one of its greatest enemies, and feeds greedily upon it. I have received it from Hertfordshire, and some other inland counties. It spawns at the end of April or the beginning of May, and feeds upon worms, insects, and dead or even putrid animal matter.

Dr. Parnell and Dr. George Johnston have noticed this species as found in the Forth and in the Tweed.

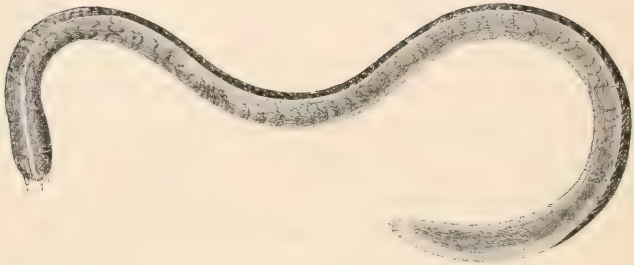
Mr. Couch says, "I find this species frequents our smaller streams in Cornwall, living in the muddy bottom, from which it rarely, if ever, willingly emerges. I have kept it for months in stagnant water, with mud at the bottom, without injury to its health or activity. The only apparent use of its fins is to enable it to regain its station, when forced from it by violent torrents. When kept in clear water it seems to sleep much. I have never found this species to attach itself to any object by the mouth; but the lips are capable of extensive and complicated motions. Our fishermen collect them to use as bait for their hooks when whiffing for Pollacks."

All the British Lampreys are found in the waters of Ireland, and this diminutive species has been taken in the north, the east, and the south.

The upper lip and the mouth in this species, as shown in the enlarged representation of the lower surface of the head under the figure of the whole fish, is in the form of a horse-shoe; the inner part furnished with numerous short and slender membranous cirri; "the lingual and palatine plates somewhat harder than the other portion, but no true teeth:" on the top of the forehead is a small orifice and canal, which leads to the internal tube between and connected with each lateral set of branchial cells, as in the Lampreys; the eye is very small, so much so as to have been occasionally overlooked, and it is situated at the bottom of a small and deep depression: the branchial apertures are seven on each side, arranged along a kind of lateral groove: the body of the fish at this part is rather tumid; behind this the form of the body is nearly round, the portion beyond the anal opening compressed: there are two dorsal fins, the first short and low, the second longer and higher, with a distinct diminution between it and the first dorsal fin, and also with the dilated membrane forming the caudal fin, which is somewhat rounded, the fleshy portion of the tail being pointed; a narrow slip of membrane forms an anal fin.

Some variations occur in specimens of this fish from different localities, and there is even reason to suppose that two species may exist. The most frequent colour is yellowish brown, approaching to blackish brown on the top of the head and upper part of the back, much lighter underneath and on the fins.

CHONDROPTERYGII. *PETROMYZIDÆ.*



THE MYXINE.

GLUTINOUS HAG, AND BORER.

Gastrobranchus cæcus,	*Blindfish,* Bloch, pt. xii. pl. 413.
,, ,,	Cuvier, Règne An. t. ii. p. 406.
,, ,,	*Glutinous Hag,* Penn. Brit. Zool. vol. iii. p. 109.
Mixine glutinosa,	Linnæus.
,, ,,	*Glutinous Hag,* Flem. Brit. An. p. 164, sp. 4.
,, ,,	,, ,, Jenyns, Man. Brit. Vert. p. 523, sp. 213.

Gastrobranchus. *Generic Characters.* — Body elongated, cylindrical, smooth; dorsal fin very low, continued round the tail to the vent; a single spiracle on the head communicating with the interior; lips surrounded with eight barbules or cirri; mouth with one hook-like tooth; tongue with two rows of teeth on each side; branchial apertures two, placed under the commencement of the belly.

The worm-like form of the fish figured above induced several systematic authors, including Linnæus, to class it with the Worms; and it was not till after dissections and published descriptions that its true relations with the Lampreys were acknowledged. Of these memoirs, that furnished to the French Institute in 1797 by Bloch, the ichthyologist of Berlin, will be read with interest; and the substance of it will be found in the twelfth part of his valuable work on Fishes, in which the internal structure is rendered obvious by various coloured illustrations.

In the family of fishes now under consideration, the last of vertebrate animals, the spinal column is in a rudimentary condition. In the Lampreys it is but indistinctly divided into rounded portions. In the Myxine, in place of a series of bones composing the vertebral column, there is merely a soft and flexible cartilaginous tube;* while in the diminutive fish next to be described, which is the last of the British species, this support is reduced to a small and slender semi-transparent column, extending throughout and connecting the whole length of the body like the flexible horny pen in some species of Cephalopods, and to which class other relations of structure both in the Myxine and in this small fish will be pointed out.

As a British fish, the Myxine occurs most frequently on the eastern coast. "It enters," says Pennant, "the mouths of other fish when on the hooks attached to the lines which remain a tide under water, and totally devours the whole except the skin and bones. The Scarborough fishermen often take it in the *robbed fish* on drawing up their lines." On this part of our coast it is called Hag, and also Borer, because, as others say, it first pierces a small aperture in the skin, and afterwards buries its head in the abdomen or body. It is most usually found in the body of the Cod, or some other equally rapacious fish.

For the only specimens of the Myxine I ever possessed, I am indebted to the unremitting kindness of Dr. George Johnston of Berwick, who has assisted me most materially by sending me examples of many interesting species which have been referred to throughout this work. The Myxine is not uncommon at Berwick; but it is only to be obtained at a particular season of the year in one or two particular localities, when during fine weather, at the end of spring or the beginning of summer, the fishermen lay their long lines on a bank with a soft mud bottom near that coast when fishing for Cod and Haddock. It is considered by some that the Myxine, which is without eyes, obtains access to the interior of the body of the fish by passing in at the anal aperture; others endeavour to account for its being found in the belly of a voracious fish by supposing it had been swallowed; while many experienced fishermen still repeat their belief that the Myxine enters the mouth of the Codfish while it is hanging on the line. It is conjectured that the Myxine does not fasten upon any fish unless it be either dead or entangled on a hook: but how a fish that is blind is able to find its way to a particular aperture, is a matter not easily explained. The eight barbules or cirri about the mouth of the Myxine are, there is no doubt, delicate organs of touch, by which it obtains cognizance of the nature and quality of the substances with which they are in contact; and its single hooked tooth upon the palate enables it to retain its hold till the double rows of lingual teeth are brought into action to aid the desire to obtain food.

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* If a section be made, a probe passes readily in either direction.

The high northern geographical range of this singular fish is shown by M. Nilsson including it among the fishes of the shores of Scandinavia, where, he adds, four and even six examples have been found within the body of one Haddock, the flesh of which was entirely consumed. Gunner includes it, with a figure, in the Natural History Memoirs of Drontheim, as taken on the west coast of Norway. Mr. Thompson records it as found at Belfast; and Mr. Couch names it as occurring, though rarely, on the coast of Cornwall. The Myxine is oviparous, and the ova are of the same colour, size, and form as those of the Lampern,—that is, small, round, and yellow.

Along the whole length of the under surface of the body, from head to tail, there are two rows of mucous pores, from which a large quantity of a gelatinous secretion is expressed occasionally at the will of the animal, and by which, either in reference to its quality or quantity, or both, this fish is said to escape its enemies. So copious and so thick in its consistence is this jelly-like secretion, that some of the older naturalists believed this fish had the power of converting water into glue, and it obtained in consequence the name of the Glutinous Hag.

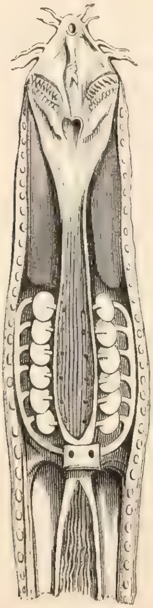
The body is elongated, eel-like in form, cylindrical throughout the greater part of its length, tapering and compressed towards the tail; the whole length from twelve to fifteen inches; the skin perfectly smooth and unctuous; the head obtusely pointed, with a single spiracle connected with the interior of the mouth and branchiæ; eyes wanting; eight tentacula, cirri, or feelers, as they are called, are placed about the lips, four near the front, and two on each side: lips soft, extensible, inclining to a circle in their figure; one single hooked tooth on the palate; the tongue furnished with four rows of small pointed teeth, two rows on each side: at the division between the thoracic and abdominal cavities are two external apertures, each of which is connected by a membranous tube with the six branchiæ on its own side; hence Bloch's name of *Gastrobranchus.* The anal aperture is an elongated fissure situated about two inches before the end of the tail; along the whole under surface of the body are ranged two rows of pores, which afford egress to the secretion of the numerous glands within; the dorsal fin is low and rudimentary, except towards the tail, where the membrane is dilated, and being continued round the end of the tail, and thence upwards to the anal aperture, forms in addition a caudal and an anal fin, which no doubt materially assist this fish in swimming. In colour the Myxine is dark brown along the back, lighter chestnut brown on the sides, and yellowish white underneath.

The vignette here added is from a drawing by Mr. Clift, engraved for the Philosophical Transactions for the year 1815, where it illustrates a paper by Sir E. Home on the organs of respiration in the Lamprey and Myxine.

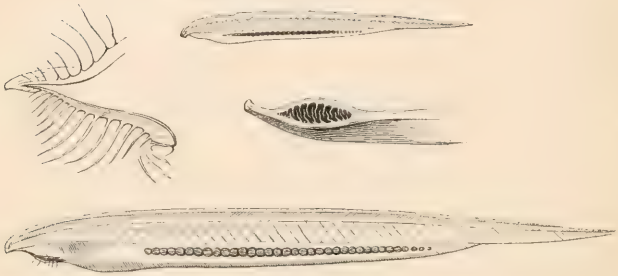
The upper angle of the figure exhibits the single spiracle, about it the eight tentacula, on the centre of the palate the single hooked tooth ; to the right and left are the double rows of lingual teeth : an inch below, on each side, are the six branchial cells, with their internal communications with the central canal ; on the outside each cell communicates with a tube that is common to the six cells on that side, which, passing downward, ends at the external aperture below. Beneath this is the stomach and intestinal canal, which, as in the Lamprey, is straight ; the rounded marks along the margin on both sides from end to end show the numerous mucous glands that have already been referred to. It is impossible to dissect a Myxine, and attend to the structure and substance of its investing skin, without being forcibly reminded of its great resemblance to the investing mantle of the Cephalopods.

The relations of structure in the Myxine to the Lampreys on the one hand, and the first class of mollusca, the Cephalopods, on the other, appear to prove that the situation claimed for this fish by Bloch, and systematic authors since his time, is the natural one. The relation to the Lampreys is shown in the elongated, cylindrical form of the body ; the single spiracle on the head ; the general similarity in the parts of the mouth ; the character of the branchial cells, and the viscera.

The relation to the Cephalopods is apparent in the eight tentacula or feelers about the head, the horny but flexible nature of the columnar support of the body, the character of its external covering, and by the power of ejecting a copious secretion whenever it considers itself in danger.



CHONDROPTERYGII. *PETROMYZIDÆ.*



THE LANCELET.

Amphioxus lanceolatus, Yarrell.
,, ,, Couch, Mag. Nat. Hist. 1838, and Corn. Fauna, p. 54.
Limax ,, Pallas, Spic. Zool. X. p. 19, t. i. fig. 11.

Amphioxus. *Generic Characters.*—Body compressed, the surface without scales, both ends pointed; a single dorsal fin extending the whole length of the back; no pectoral or ventral fins; mouth on the under part of the head, narrow, elongated, each lateral margin furnished with a row of slender filaments.

The singular little animal here figured of the natural size, although one of the smallest, as well as the last, among British fishes, is by no means deficient in interest. The specimen, the only one I ever saw, and which is probably also the only one that has been taken for many years, was sent to me by Mr. Couch, who found it himself on the shore near Polperro. A portion of the tail of this little fish was sticking out from underneath a stone in a small pool left by the tide. Mr. Couch perceiving it, took it up with some water in the hollow of his hands. It was alive, very active, and so transparent that the viscera were perceivable through the external covering. It was taken home by Mr. Couch, who made a drawing of its appearance under a microscope.

The only notice of this little animal on record that I have become acquainted with, which was pointed out to me by my friend Mr. I. E. Gray, is that by Pallas, in his *Spicilegia Zoologica*, already quoted; and I insert at the foot of the page, as a note, the Latin description by Pallas,* believing that the reader will then have before him all that has been published of this very rare little animal, of which, at least as far as I am aware, possibly no other specimen has been found or noticed since that to which Pallas refers, and which, it is not a little singular, was also obtained from Cornwall.

Of the specimen in his possession Pallas says, "Quod nunquam vivum vidi, sed liquore servatum e mari Cornubiam adluente accepi olim, quodque prima facie refert piscem Leptocephalum Gronovii."

At first sight this little fish has somewhat the appearance of a *Leptocephalus*, a British fish first sent to Gronovius by our countryman and zoologist Pennant; it more particularly resembles it in the arrangement of the striæ on the flattened sides: but *Leptocephalus*, as will appear by a reference to the figure of it in this volume at page 409, has a perfect head, though a small one, with jaws, teeth, eyes, and gill-covers; while the fish under consideration has neither eyes nor gill-covers, nor any fins except one along the back, which forms an anal fin by passing round the tail.

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* "Limax lanceolatus. Corpus anceps, planum, lineari lanceolatum, utrinque acutissimum. Margo undique limbo membranaceo auctus; subtus vero ad duas tertias longitudinis margo bilabiatus est, sulcatusque, ut sit quasi pes limacinus angustissimus. Tentacula plane nulla. Latera striis obsoletis, antrorsum obliquatis prope dorsum angulo recurvatis, ut quasi latus pisciculi desquamatum referant."

Supported by the opinion of Mr. Gray, and two or three other zoological friends, I have placed this little animal in this family, near the cyclostomous fishes, believing it to be, as far as at present known, the lowest in organization among this class; and although I am unwilling to mutilate entirely by my rough dissection the only specimen probably I shall ever possess, and which is perhaps unique, I shall yet be able to show, by the figures given and some further description, that this animal is entitled to a place at the end of the present family.

The form of the fish is compressed; the head pointed, without any trace of eyes; the nose rather produced: the mouth on the under edge, in shape an elongated fissure, the sides of which are flexible; from the inner margin extend various slender filaments, regularly disposed, which cross and intermingle with those of the opposite side. Along the sides of the body the muscles are arranged in regular order, diverging from a central line, one series passing obliquely upward and backward, the other series as obliquely downward and backward: the anal aperture is situated one-fourth of the whole length of the fish, in advance of the end of the tail; the tail itself pointed: from the nose to the end of the tail a delicate membranous dorsal fin extends the whole length of the back, supported by very numerous and minute soft rays; the surface of the body smooth.

The body is strengthened and supported internally throughout its length by a flexible cartilaginous column, from which the numerous muscles diverge; the cavity of the abdomen is comparatively large; the intestine a canal of considerable calibre, without convolution; above it a double row of flattened globular bodies, which have all the appearance of ova. The figure at the top of the illustration represents this fish of the natural size. The right-hand figure in the middle line is an enlarged representation of the mouth as seen from below, with the filaments from each side stretching across the opening; the outline on the left of the middle is a magnified view of the two portions of the hyoid or lingual bone, to which the filaments are attached, one branch of which bone is divided, and the cut portions turned up and down to expose the other perfect side; the figure at the base is a magnified view of the appearance of the whole fish.

Several relations in structure to the Lampreys and Myxine are observable,—namely, the fringed mouth, the armed lingual bone, the absence of eyes, the want of pectoral and ventral fins, the investing tunic, and the tough, but flexible, internal dorsal column. Of its habits, that which has been stated is known: it is extremely active when in water, and its food is probably some of the most minute among the thin-skinned crustacea, or decomposing animal matter.

It may perhaps be expected that I should state on what grounds I have ventured to differ from such a naturalist as Pallas in considering this animal a fish, and not a *Limax*. It is distinguished from the *Limaces* by the absence of the ventral muscular disk for locomotion; and from every other molluscous genus, in the position of the anal aperture, which is unconnected with the respiratory cavity. On the other hand, the dorsal fin, and regular oblique strata of muscular fibres clothing the sides of the body and having their points of origin attached to a firm dorsal internal axis,—with the existence of a lengthened internal vertebral column, although in a soft cartilaginous state, as in the Myxine,—are sufficient to determine the primary division of animals to which the *Amphioxus* belongs.

The publicity given to this little animal, which appeared not to have fallen under observation since the time of Pallas, and the situation claimed for it, in the first edition of the History of British Fishes, have led to many satisfactory results. My friend, Mr. Edward Forbes, told me that he had obtained two specimens. These were dredged up by himself from a sandbank in deep water on the east coast of the Isle of Man ; they were extremely active, and on superficial examination resembled small Sand-eels. With his characteristic liberality, he placed these two specimens in the hands of Mr. John Goodsir, Conservator of the Museums of the Royal College of Surgeons in Edinburgh, with a request that he would employ them for the purpose of drawing up a detailed account of the animal. This account, forming an elaborate anatomical paper, is published in the fifteenth volume of the Transactions of the Royal Society of Edinburgh, to be hereafter referred to.

Finding that I had originally misunderstood some of the circumstances connected with the capture of the first fish by Mr. Couch, I here insert with pleasure Mr. Couch's own statement, as now published in his Fauna of Cornwall, p. 54. " When alive, this fish had a very evident, though diaphonous fin, extending from near the snout, round the extremity of the tail, which it encircled in the manner of the same organ in the Eel, and terminating at the vent ; and the appearance in the engraving is probably owing to the influence of the preserving liquor, which has caused the membrane to contract. The rays of this fin are arched transversely, in a very singular manner. The specimen was not found in a pool, but lay buried in a small quantity of sand, at about fifty feet from the receding tide ; and on turning over a small flat stone that was on the sand, the tail of the fish appeared exposed. When moved it exhibited signs of great activity, so that the head could not readily be distinguished from the tail ; and as there can be no doubt that the fish had sought the shelter of the sand in which it was found, there is little question that such is its usual habitation : a circumstance still more probable by its want of eyes. It was discovered on the 21st of December 1831, after a heavy storm that had torn it from its native situation, which, from its rarity, we may suppose to be in deep water. In February 1838, I obtained two other specimens, which had been thrown up by a tempest. The largest measured two inches and three-tenths in length, which enabled me to discern still more of the internal structure of this fish."

The Zoological Society have since received two specimens of the Lancelet, which were forwarded in a small bottle, with several examples of *Leptocephalus Morrissii*,* from the Mediterranean, by the late Dr. Leach, but no particular locality was named with them.

I had the pleasure of receiving a visit from Professor Müller when he was in London in 1837, and placed before him for his examination the opened specimen of the Lancelet from which I had taken my description. Professor Müller has since received two examples, and the result of his dissections, embodying also observations by Professors Retzius and Sundevall of Sweden, will be found in the Proceedings of the Academy of Berlin for 1839, page 197. The Lancelet has now been taken on the coasts of Norway and Sweden.

I overlooked the membranous folds of the abdomen and the anal fin. Mr. Couch anticipated, and very kindly stated the true cause of the omission,—the contraction delicate membranes undergo from long immersion in spirits. The fish was caught in December 1831, and was examined by me in the summer of 1836. These parts are thus described by Mr. Goodsir:—"The folds commence, minute, on each side of the hyoid apparatus, pass back on the sides of the abdomen, increasing in breadth till they are as broad as one-fifth of the depth of the animal; they then diminish and terminate at the point where the muscles approach on each side of the intestine,—that is, at the junction of the middle and posterior thirds of the animal."

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* Brit. Fish. vol. ii. p. 409.

"The anal fin is a fold of integument, which, commencing at the point where the abdominal folds terminate, is continued to the anus, where it is interrupted, but reappearing behind it, and becoming broader, passes on to be continuous with the dorsal fin at the extremity of the tail. The existence of a median fin in front of the anus is, as has been observed by Müller, very remarkable; but it is in exact accordance with a fact mentioned to me by Professor Agassiz, that in certain fresh-water fishes,—the developement of which he had watched,—a fin of this kind, with rays, exists for a short period of their embryonic existence, and then disappears."

The minute anatomical details of Professor Müller and Mr. Goodsir are unsuited to popular pages; the conclusion appears to be that the zoological position of *Amphioxus* is the lowest place in the Class of Fishes, and the discovery of a second species in the Mediterranean by my friend Mr. Wilde, which possesses a circular mouth, and some observed habits in the original species, both having been found at Algiers, seem to confirm the connexion of these fishes with the Myxine and Lampreys.

Extract from a Narrative of a Voyage to Madeira, Teneriffe, and along the shores of the Mediterranean, by W. R. Wilde, M.R.I.A.

"As I obtained several of the Lancelets during our stay at Algiers, I may be permitted to offer some observations on them. There were two descriptions; the first, and most common, about an inch and a half long, the *Amphioxus lanceolatus* of Yarrell and the *Limax* of Pallas, who first noticed it. The body is diaphonous, and enclosed in a thin flexible envelope, not circular, but preserving a five, and, in some instances, a seven sided figure. This in every respect resembles the calamus or pen of some of the Mollusca, especially that in the common cuttle-fish. These little animals had a power of attaching themselves to each other in a remarkable manner, sometimes clustering together, and at others forming a string six or eight inches long; the whole mass seemed to swim in unison, and with great rapidity, going round the vessel in a snake-like form and motion. They adhered to one another by their flat sides; when in line, the head of one coming up about one-third on the body of the one before it; no doubt those sides are of use in forming this attachment. The other variety was thinner, and from two and a half to three inches long, having a large dorsal fin, which moved continually in an extraordinary manner, describing a circle by rotating upon its narrow base. The mouth was a circular disk, surrounded by ciliæ that continued in constant motion. When put into a tumbler of water it moved round the glass, and although no eyes were perceptible, it carefully avoided the finger, or any substance put in its way, stopping suddenly, or turning aside from it. Both these animals when taken out of the water kept up a strong pulsatory motion for some time. The small one, the *Amphioxus lanceolatus*, by this means pumped out of its interior a quantity of air and water; and they could be seen coming to the surface to inhale, and a globule of air was observed floating through the internal cavity. In the larger species the internal tube was perfectly distinct, and of a blue colour. When put into spirits and water it died almost immediately, and turned opaque. A number of circular bands also appeared on it. Mr. Yarrell, in his beautiful work on British Fishes, has placed this singular little animal among the finny tribe. With all due deference to him, I would suggest the following reasons for it belonging to the Mollusca: the absence of vertebral column, the transparency, and the thin flexible skeleton of the animal being external."

At the time of writing this Mr. Wilde was not aware of the dissections and consequent conclusions of others.

Searching Beckwith's enlarged edition of Blount's Tenures, I found those that here follow; which, as they refer to fishes or fishing, may be considered entitled to a place in this work.

" In the simplicity of older times, when gold and silver were scarce, the household of the king was supported by provisions furnished from his demesnes. By degrees the servants here employed obtained a fixed tenure of the estates, rendering certain services, and supplying certain provisions. Many lands were from time to time granted on condition of yielding such supplies; but these reservations were small, and many of them only to be rendered when the king travelled into the country where the land lay. In some, special care was taken that he should not make this service burthensome by coming too often.

" *Aylesbury.* — William, son of William of Alesbury, holds three yard-lands of our lord the king in Alesbury, in the county of Bucks, by the serjeanty of paying three Eels to our lord the king, when he should come to Alesbury in winter.

" *Conway Castle* — Is now held of the crown by Owen Holland, Esq. at the annual rent of six shillings and eight pence, and a dish of fish to Lord Hertford as often as he passes through the town.

" *Degemue and Eglosderi, county of Cornwall.* —William Trevelle holds one Cornish acre of land in Degemue and Eglosderi, by the serjeanty of finding one boat and nets for fishing in Hellestone Lake, whensoever our lord the king should come to Hellestone, and so long as he should stay there.

"*Gloucester.* — Pennant states that it has been an old custom for the city of Gloucester annually to present the sovereign with a Lamprey pie, covered with a large raised crust.

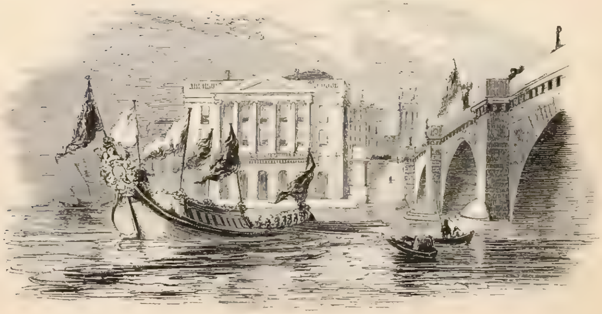
"*Rodeley, county of Gloucester.*—Certain tenants of the manor of Rodeley pay to this day, to the lord thereof, a rent called Pridgavel, in duty and acknowledgment to him for their liberty and privilege of fishing for Lampreys in the river Severn. Pridgavel: Prid, for brevity, being the latter syllable of Lamprid, as this fish was anciently called; and gavel, a rent or tribute.

"*Stafford.*—Ralph de Waymer held of the king in fee and inheritance the stew or fish-pond without the eastern gate of the town of Stafford, in this manner, that when the king should please to fish, he was to have the Pikes and Breams; and the said Ralph and his heirs were to have all the other fishes with the Eels coming to the hooks, rendering therefore to the king half a mark at the feast of St. Michael.

"*Yarmouth.*—The town of Yarmouth in Norfolk is bound to send to the sheriffs of Norwich a hundred Herrings, which are to be baked in twenty-four pies or pasties, and thence delivered to the lord of the manor of East Carlton, who is to convey them to the king. They are still sent to the clerk of the kitchen's office at St. James's. In 1778, the sheriffs of Norwich attended with them in person, and claimed the following allowance in return, viz.—'Six white loaves, six dishes of meat (out of the king's kitchen); one flaggon of wine; one flaggon of beer; one truss of hay; one bushell of oats; one pricket of wax; six tallow candles.' But no precedent appearing of these things having been delivered, they were refused.—*Records of the Board of Green Cloth.*"

The vignette closing this second volume of the second edition of the History of British Fishes, represents the New Hall and the Barge of the Company of Fishmongers of London.

The final vignette to the first volume represents the Old Hall of the Company, and the arms on the title-page of the first volume are also those of the Company.



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